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Engineering

Electrical World

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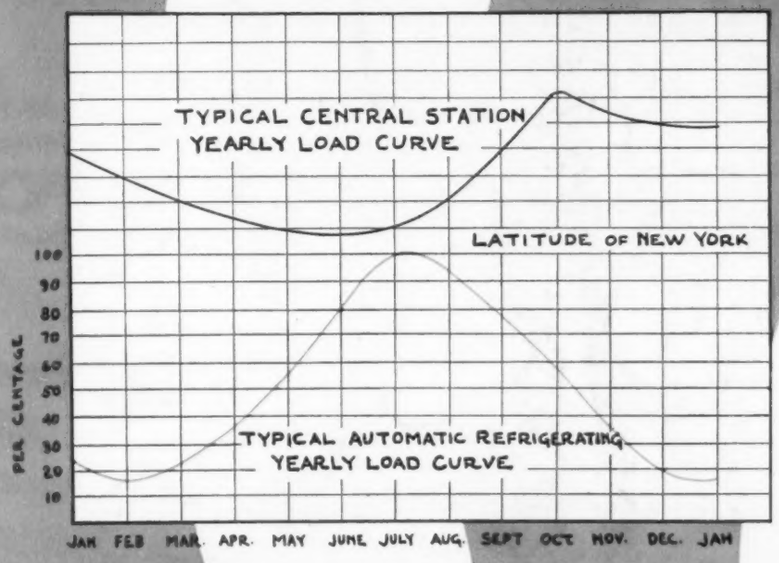

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Volume 79 — New York, Saturday, April 1, 1922 — *Number* 13

Our Waiting Ships

WE, THE people, are possessed of many ships. Idly they lie waiting on the placid harbor waters. Fifteen hundred bottoms gather barnacles—waiting for what and why?

These ships were built to win a war. They cost $250 a ton. The war was won. They are now worth say $25 a ton, and the difference charges not against the ships but to the price of war. But we, the people, own the ships. It has become a business problem for America. What shall be done?

THERE are two reasons why nobody buys these ships. We make it cost too much to operate our higher-priced vessels under American registry by setting a standard of both food and wages that impoverishes the ships. We make it possible for a Swedish sailor to come to America, take out his papers, earn $90 a month on a Yankee ship, where he earned $40 formerly, live better and send his money home. So the Yankee skipper cannot compete. And who buys ships to make a loss?

That is one reason, and the other is a matter of trade conditions. Americans have stayed at home engrossed in the immediate problems of developing the U. S. A. They have not put a trader in every port, as have the British and the Germans, to insure a carrying cargo to each ship that calls. And so we have another disadvantage that only time and trade will overcome.

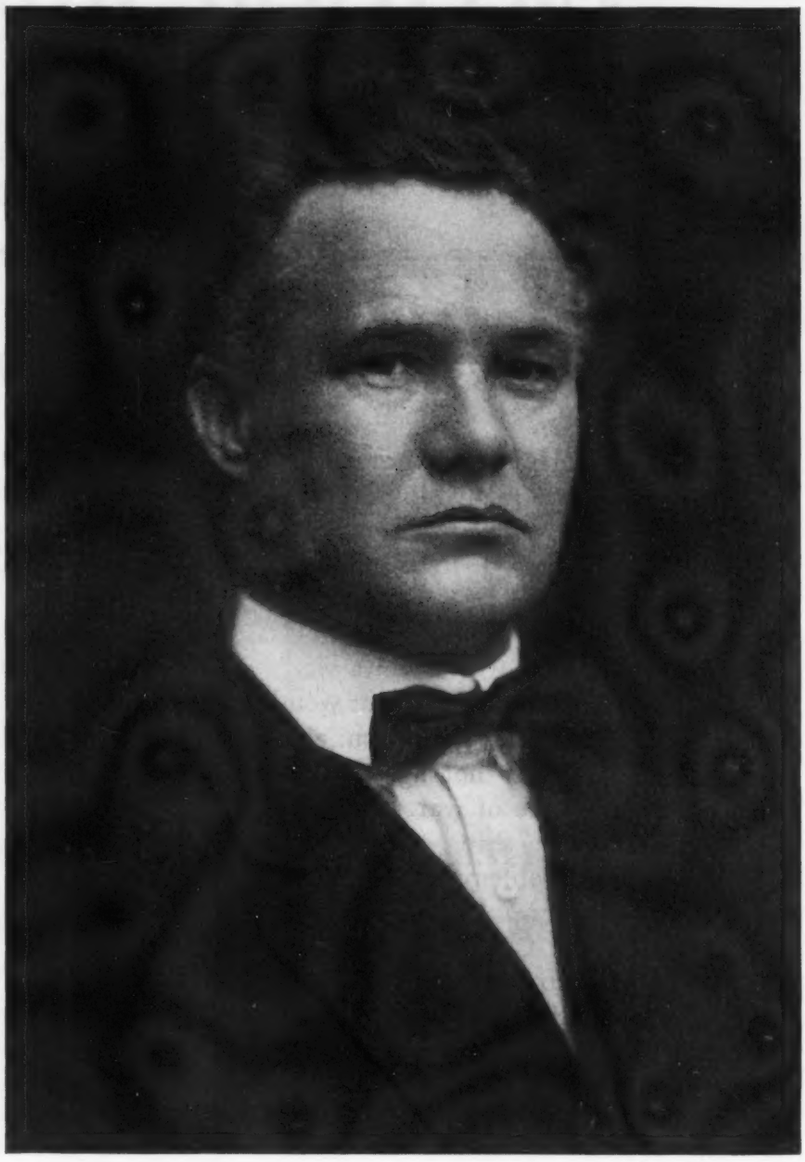
But we possess the ships. And we have things to sell. And all the world offers its goods. Taken together it presents a problem and an opportunity. American industry must act.

SUBSIDIES are not popular in this country. The word smacks of politics in business, and government operation has proved bad. But we face a matter of costs. The United States Shipping Board, after long study, recommends a subsidy—to balance the penalty of our Quixotic seamen's law until it shall be changed, and to encourage American traders to enter the foreign fields, until our ships can ply from friend to friend, and the great profitable future of our foreign trade can gradually unfold. And the subsidy will cost perhaps 40 per cent of what we will lose by scrapping all these ships or giving them away.

Our transcontinental railways were made possible by subsidies of land. Our export trade—in which the electrical industry will open up some day a mine of wealth—may wait upon a similar impulse. Surely it is better that the products of our ingenuity—already famed around the globe—should be sold abroad, aided for a time by subsidy, than that the present opportunity should be wasted at even greater cost in ships.

William Suddards Franklin

Teacher and physicist whose original and high-minded service to engineering education spans a generation.



TO MEASURE the indebtedness of a rapidly developing industry to those who teach its underlying science is an almost impossible task. The ever-invisible limits of a capable teacher's influence expand with the years. His personality and work bear fruit in the success of the men who are out attacking the complex problems of the day through effort made more effective by rigorous training. The rewards of a true teacher of science may never be gathered together for enumeration, but the reality of his influence is no more to be doubted than the power of current thought in controlling the affairs of men. Happy, therefore, should be a man like William S. Franklin, who considers teaching "the greatest of fun" and who finds himself after thirty-five years of service keeping the scientific faith with keen enthusiasm for its advancement and a wise comprehension of the limitations and possibilities of the student.

Professor Franklin was born in Geary City, Kansas, Oct. 27, 1863, and was educated at the University of Kansas, at the University of Berlin and at Harvard University, where he held the Morgan Fellowship in 1891-2. Later he studied at Cornell University, from which he received the degree of doctor of science in 1901. From 1887, when he took the post of assistant professor of physics at the University of Kansas, Professor Franklin has concentrated his attention upon this branch of science, also teaching electrical engineering at Iowa State College from 1892 to 1897 and at Lehigh University from 1897 to 1903. From 1903 to 1915 he occupied the chair of physics at Lehigh. In 1917 he was called to the Massachusetts Institute of Technology as lecturer in physics, and in 1919 he was made full professor of that subject.

Dr. Franklin is known widely outside academic circles as an author of numerous papers on scientific subjects, and within the allied fields of electricity and physics his output in the form of singularly lucid and usable textbooks has won him a national reputation as an educator. Among his works, written individually or as co-author, are volumes on electrical engineering, alternating currents, generators and motors. "Electric Waves," "Elements of Mechanics," "Elements of Calculus," a "Calendar of Leading Experiments," "Practical Physics," and "Bill's School and Mine," a collection of pungent essays on education. Professor Franklin's originality of viewpoint on educational matters and his championship of clarity in instruction without committing "the fatal error of being exacting and unintelligible" are equaled by his loyalty to the scientific spirit—a devotion which loses nothing from his interest in the "humanities."

Dr. Franklin is a member of many scientific societies, is a fellow of the American Association for the Advancement of Science and past-chairman of the physics section, past-president Iowa Academy of Sciences, former councilor Society for the Promotion of Engineering Education and a member of the American Physical Society. During the summer of 1918 he investigated aëronautics at the Bureau of Standards, Washington, and he is continuing researches in this field for the government at the Massachusetts Institute of Technology.

Editorial Comment

Electrical World, April 1, 1922

Volume 79 Number 13

Incompetency of Government in Business Affairs

NO ONE giving serious thought to the matter ever expects the government to do anything cheaply or efficiently. Yet there is a constant cry on the part of the uninformed for government ownership and operation. Undemocratic it is, to be sure, but what heed do politicians, ill versed in democratic institutions, give to that? Spoils are their goal and nothing else matters.

Last week a premier international figure in retail commerce, H. Gordon Selfridge of London, arrived in the United States. It so happened that when Mr. Selfridge landed in New York the British Ambassador, Sir Auckland Geddes, was speaking on the Pacific Coast.

Both of these men discoursed upon the evils of modern government, and their views, when brought together, make an excellent presentment. Selfridge says: "Just now there is too much government everywhere, too much of taxes, too many enterprises being carried on by government bureaus. Many of these should be carried on by private individuals. Remember that the money used for these enterprises is the people's money and has to be furnished by taxation. Put these things back where they belong, and the result would be that taxation would be reduced and everybody except the office holders would be satisfied. That government operation rarely is made to pay is shown by the Glasgow tramways. These are being operated in arrears and the deficit supplied from the Glasgow treasury." Geddes says: "The vast majority of men in public life are in mental capacity and knowledge far behind the best minds and the best thought as represented by the highly specialized university professor. That knowledge which is power is not present in our government today." Selfridge is right. We suffer from too much government. Geddes is right. Those who govern are not fit to govern. Ideal democracy cannot thrive while inefficiency and incompetency prevail, and the less we have of such government in business affairs the better.

These "Outsiders" Who Sell Appliances

WHEN the first industrial machinery came into use it was violently opposed by labor because it was believed that it would throw men out of work. As a matter of fact, it merely increased the output of industry and the service and wealth of mankind, and yet this idea has persisted. The policy of the labor unions, particularly in the building trades, has been to hold back rather than to speed up the job, and to restrict rather than to increase the work that a man can do, and there has been less work because it has been made so costly.

The point of view so commonly expressed, that non-electrical merchants should be prevented some way, somehow, from selling electrical appliances, is another example of the same kind of wrong economic thinking. It is an attempt or a desire to keep the trade small for the benefit of the men already engaged in the business, to limit the development of the industry for fear some outsider might share in the opportunity, forgetting that the first consideration is to get the appliances sold and build up the industry by increasing the use and popularity of everything electrical. For, in order to grow, the electrical trade must continually attract to this business of selling electrical merchandise more and better men with bigger and busier stores.

No man who knows the electrical industry and sees the trend of its unfolding can doubt the opportunity for every man now in the business. The success of the individual will only be measured by his own capacity for progressive achievement. The activity and prosperity of the central-station appliance shop will increase year after year, for it has an established contact with all the people that makes installment selling simple, profitable and secure. The central station will continue to be the greatest outlet for appliance selling, and the electrical contractor-dealer too will continue to market an ever-growing volume of this household equipment. But also the department store and the hardware store and the furniture store, as the market grows, will give more and more attention to the sale of these devices, and we should all be glad. The great purpose, the alluring common opportunity, is to expand and quicken the electrical business, no matter who does the selling. We shall all share in the benefits according to our worth, and we must think straight about these so-called "outsiders" who sell appliances.

Let Us Have the Whole Truth on the Coal Situation

HOW long will an outraged public endure patiently its annual struggle with the powers that control the coal fields? It is high time to arise and smite the despoiler whoever he may prove to be, whether organized labor, organized capital, or an unholy combination of the two impelled by a common desire for loot. We are glad to see that a government investigation of the whole question is likely to start. Investigations, however, instead of laying the cornerstone of reform, sometimes produce merely noise to drown the growing clamor of those who suffer. With whatever honesty of purpose this particular investigation starts, we trust that it will be charged with plenary power sufficient to find out and make public the truth.

Nobody at present seems to be able to discover how much a miner earns, how much profit an operator makes, or what is a proper charge for transportation. As between operator and union, neither side seems to be willing to play with cards upon the table, or to disclose frankly what the real conditions with which it is contending are. On one side you will hear that the industrious miner can make $5,000 a year, on the other that

he is drawing his belt tighter in impending starvation. The public pays the bills and has the right to know the whole truth. To this end the official investigators must have authority to summon witnesses and put them under oath, to place auditors on the books, and to ask the secret service to be on the alert for evidence of perjury by whomsoever committed.

The operators proclaim to the press that the miners will not work steadily and insist on a five-day week and six hours a day. The miners assert that they do not get a fair chance to work because the operators have been skillfully organizing a perpetual shortage of coal. It is time to find out which contention, if either, is correct and also to discover what mysterious intermediaries, if any, get away with a considerable part of the price the consumer has to pay, and, incidentally, what price is charged consumers within sight of the breakers, with the transportation eliminated. This investigation should be thorough and conclusive, leading to action that will at once and forever bring the remedy demanded. The thing at stake is nothing less than the continuance of our present industrial civilization. If fuel costs rise in the next ten years as they have in the last ten, the inevitable result will be the decadence of industry in regions where humanity has to depend on artificial heat during a large part of the year. We know the resources of the country in "white coal," and we know also that they are not enough to save or greatly to ameliorate this threatening situation.

The electrical industry in particular is the victim of the warring forces in the coal fields. It has to pay such prices as they formulate in their struggles, but it has to sell its product at such prices as commissions deem fair and right in protecting the public. If the public should be guarded against unwarrantable profit on the part of central-station companies, why should it not also be saved from the possible extortions of those who supply fuel to both station and private consumer? We see no reason why commissions should not be authorized to take as full charge of the supply of fuel to the people of the country as they do of the supply of electricity to the same individuals. The products of both mine and central station are necessary to the maintenance of our existing civilization, and if one should be subject to regulation in the public interest, so also should be the other.

Character in the Humbler Employee

EMPLOYEES of central-station companies are selected and paid according to the work they are hired to do. It is the job, the task that is set them, that governs the type of man chosen and the compensation paid. This is the traditional and natural viewpoint and method, but it overlooks entirely the fact that every employee contributes to the situation another thing besides his work, and that is *influence*. And this influence is not dependent upon his salary but on his character. In selecting a man to do a definite work, therefore, something more than his ability to do the work should be considered, for the influence of his character in that job may be a factor of far greater importance as it affects public relations.

Following out this line of thinking, E. L. Milliken presents in this issue a chart which shows a comparison of the number of times that different classes of central-station employees come in contact with the public. It is a most important point. It demonstrates that some of the humbler jobs, in point of skill required, are clearly the most vital when the need for character is considered. A meter reader or collector can be hired for little pay, but each of these men will meet in a single day more customers than an executive will talk to in a month. The character of the man who fills this secondary job is of primary importance, and he should be selected not just for the work to be done, but for the opportunity that this work will bring to spread a good influence for the company.

Mr. Milliken has put his finger on something that every utility executive should think about. It has been the custom to pick for these small jobs men of small capacity for work. But because they have been small in character also they have been great in capacity for wasting opportunities to win friends for the company. Yet the reading of the meter or the collecting of the money may, after all, be of less importance than the contact with customers. Perhaps the man might far better have been selected and paid for the influence of his character. Good character would not have made his work less accurate.

British Imperial Wireless Chain

A CHAIN of wireless stations practically encircling the world is the subject of a recent report by the Wireless Telegraphy Commission appointed by the British government. It proposes intercommunication among stations extending from Vancouver on the west to Australia and New Zealand on the east, with a number of lateral reaches. The commission was not only empowered to determine the choice of operating system but was also asked to submit recommendations as to design and location of transmitting and receiving stations and estimates of costs both of construction and maintenance. It constitutes, therefore, one of the most elaborate studies yet made for a unified world-embracing system of long-distance radio communication. It is of great importance technically, since it deals in detail with practically all questions of design of transmitting and receiving stations.

The chief recommendations, covering nine principal stations, are that the thermionic-valve method of generation be used in the major stations, and that in the initial stages the arc method of generation be used in several subordinate stations, to be, however, ultimately replaced. Each transmitting station is to be capable of working with either of two wave lengths, as may be appropriate to the time of day and the atmospheric conditions. Each receiving station is to be provided with antennas and equipment for working simultaneously with all stations normally communicating with it.

The discussion of the thermionic generators is of special interest. A set capable of delivering at least 120 kw. of high-frequency power to the antenna is specified, with provision for extension ultimately to 240 kw. These figures are given notwithstanding the fact that neither the Admiralty nor the Marconi company, the only British manufacturer of thermionic valves, has yet succeeded in continuous operation at higher than 30 kw., although a special test of the Marconi company has delivered 100 kw. to the antenna. The equipment in this case consisted of forty-eight glass tubes rated at 2.5 kw. each. Apparently the most serious questions in the minds of the commission are the cost of replacements of tubes and the development

of manufacturing facilities to furnish them. That the recommendations described should have been made under the circumstances is an indication of the confidence of the commission in the ultimate superiority and reliability of the thermionic method of generation. The commission is headed by Lord Milner, with Dr. W. H. Eccles, the well-known radio specialist, as vice-chairman.

No reference is made in the abstracts of the report so far available to a comparative study of the several available means for generation for long-distance radio. In this country, as is well known, the high-frequency generator for radio purposes has been brought to an advanced stage of development and is in use in important stations. There are also a number of arc stations of large capacity in operation. In these columns a few weeks ago we called attention to the adoption by the Dutch East Indian Company of the arc generator for the exceptionally long distances involved in its system. It appears therefore that there is no present probability of international agreement as to a common system of transmission. In many respects this is unfortunate, as an agreement on a single system would undoubtedly greatly accelerate its development and the consequent improvement in service. The commission has, however, had in mind the discussion which has already taken place concerning an international agreement as to wave lengths, and so the feature most essential to satisfactory operation in relation to the work of other countries is taken care of. The report will undoubtedly stimulate a general discussion of international communication, and if the system recommended is constructed and operated, it will exert a powerful influence on future practice.

Economics of Electric Residence Heating

THE idea of heating residences as well as mercantile establishments by electricity has long been a dream not only of men in the industry but of the consuming public at large. There have even been efforts on the part of consumers to force the supplying of electrical energy for this purpose at rates far below those possible of attainment. A notable instance of this occurred in Idaho two or three years ago, where it was proved beyond dispute that the plan was not feasible; and from the data contributed to this issue by E. A. Loew describing an extensive experiment in electrical house heating in Tacoma, Wash., it appears that there is little present hope for the general adoption of electric heating for some time to come.

The city of Tacoma, by offering electrical energy at a figure very much lower than is usually found practicable for this class of service, has built up an extensive load for the supply of electric heating to residences. It is claimed that the city has been able to show a profit during the years in which this experiment has been under way. The great convenience which the electric method affords, as well as the freedom from dust and dirt and the elimination of the disagreeable task of tending a coal furnace, has, of course, brought demand. It is said that electric furnace plants are installed at a moderate cost—about the same as that of a hot-air coal-burning plant. In residences not equipped for furnace heating the use of either the portable or the permanently installed types of radiant heaters provides the same convenience and economies as the hot-air furnace type.

It is a principle recognized by regulatory commissions that surplus power may properly be sold for what it will bring so long as the power company's business as a whole is on a paying basis. This experience from Tacoma is interesting, not because there is any prospect of electric heating of houses becoming practicable in other cities within the near future, but because the peculiar local conditions at Tacoma have there made it possible for the first time on an extensive scale. The low cost of a small system, plus an unusual seasonal excess of water under a high head, has made power available for this experiment.

Temperature Basis the Logical One for Loading Apparatus

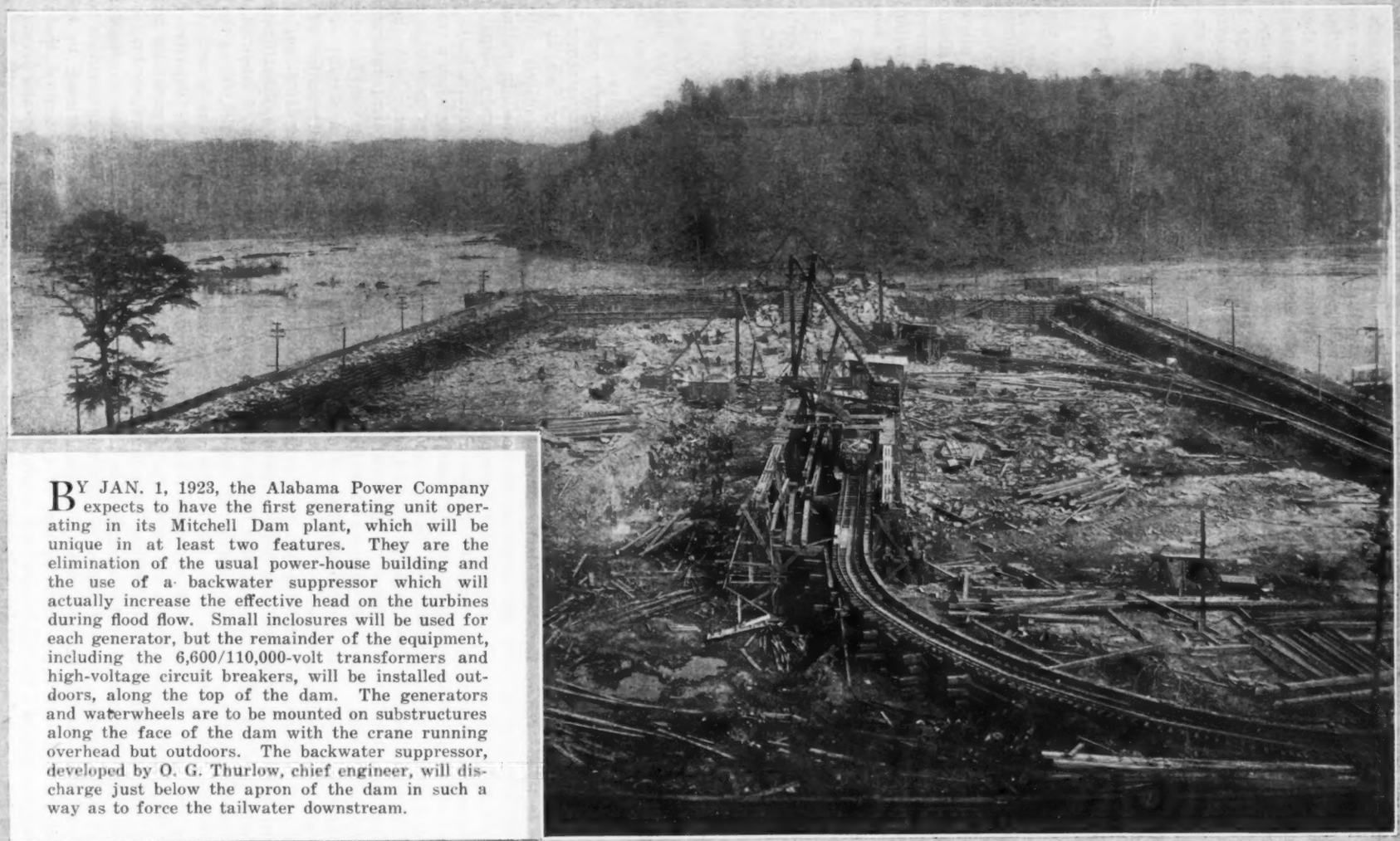
UNUSED transformer capacity costs money in idle investment and energy losses. Present economic conditions demand that such equipment shall pay its way to the limit of safe and reliable service. The real problem is the determination of allowable heating and regulation limits as regards distribution transformers. On another page L. L. Elden throws new light upon this question in a noteworthy contribution to the literature of transformer research. He who runs may read, but in a word the author has thrown down the gauntlet to the A. I. E. E. Standardization Rules and, on the basis of several years' investigation on the Boston Edison system, asks why distribution transformers should not be operated on greater temperature rises from low ambient temperatures than the Institute rules specify.

Mr. Elden's investigations point to no higher limit of "hot-test spot" temperature for class A insulation (105 deg. C.) than the Institute allows, but they do indicate the desirability of revising the allowable maximum observable rise (55 deg. C.) below 40 deg. C. ambient. Roughly, each degree below 40 C. permits a 1 per cent increase in transformer loading and vice versa. The effect of operation at high loadings on regulation appears to be entirely satisfactory, and by thus "taking up the slack" in rating below 40 deg. striking gains in transformer output are indicated.

Operation on a temperature basis with the use of suitable indicators showing when a transformer reaches the cautionary and danger points in heating logically follows these investigations. On the Boston Edison system operation on the temperature basis indicates a reduction of at least 10 per cent in transformer capacity readily attainable, with a similar decrease in annual losses. Including the elimination of the expense of changing transformers and testing, a decided burden under the old method of estimating the suitability of transformers for anticipated loadings, the total yearly savings will easily reach $30,000 in the near future.

What this means to the practical operating man, burdened as, owing to the vagaries of the appliance load and other causes, he generally is with overloaded or underloaded transformers, need not be enlarged upon. The development of indicators competent to meet the requirements of transformer service represents a new application of physical science to the tasks of the central-station engineer, and if the excellent results thus far realized are maintained—and no present evidence is forthcoming to the contrary—the utility industry will have taken a long step forward in the economic conquest of materials designed to perform varied and exacting services.

Unique Power House to Occupy This Location on the Coosa River



BY JAN. 1, 1923, the Alabama Power Company expects to have the first generating unit operating in its Mitchell Dam plant, which will be unique in at least two features. They are the elimination of the usual power-house building and the use of a backwater suppressor which will actually increase the effective head on the turbines during flood flow. Small inclosures will be used for each generator, but the remainder of the equipment, including the 6,600/110,000-volt transformers and high-voltage circuit breakers, will be installed outdoors, along the top of the dam. The generators and waterwheels are to be mounted on substructures along the face of the dam with the crane running overhead but outdoors. The backwater suppressor, developed by O. G. Thurlow, chief engineer, will discharge just below the apron of the dam in such a way as to force the tailwater downstream.

Reducing Customer Contacts to Figures*

Careful Analysis of Points of Contact with Public Shows Importance of Training Different Classes of Employees—Personal Value of Utility Employees in Promoting Good Will

Assistant Manager Blackstone Valley Gas & Electric Company, Woonsocket, R. I.

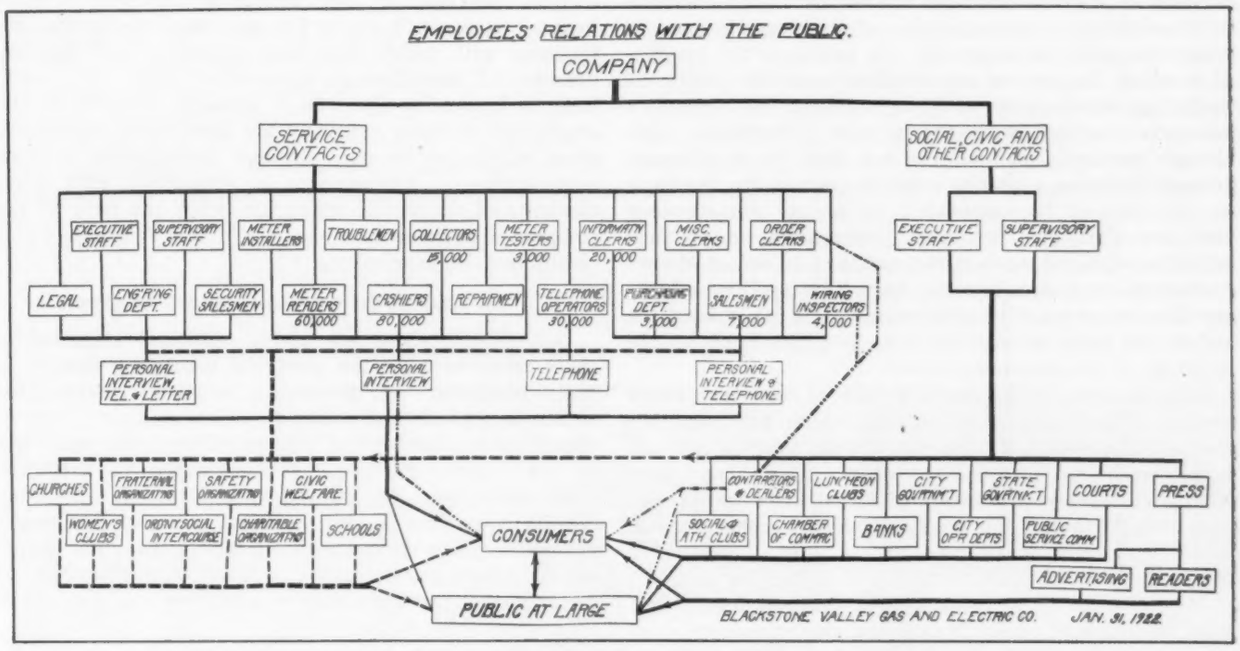


CHART SHOWS NUMBER OF POSSIBLE SERVICE CONTACTS PER YEAR BY ANY ONE EMPLOYEE

SOME months ago a representative of a large financial house was investigating a public utility certain bonds of which his principals were possibly to underwrite. Every one with whom he came in contact in the territory was loud in praise of the utility and its management. So strongly favorable were these opinions that the investigator, in talking with the general manager, just before leaving for home, asked him: "How is it that you keep your public relations in such good shape?" The executive replied: "Public relations? Great Scott! I don't have time to bother with them. I have enough to do looking after my wife's relatives." This executive had really solved the problem of satisfactory public relations, but did not recognize it under that name. The illustration serves to show that the term is a comparatively new one and is not as yet thoroughly understood.

Though the term is new, that phase of the public utility business which it covers is as old as the industry. Almost all of the methods which may be suggested at this time have actually been used for a long time by various utilities throughout the country. The connotation "public relations" merely brings all of these activities under one head, correlates them and makes possible wider consideration and discussion of how they may be used generally to the advantage of the industry.

The state of a company's public relations, in the last analysis, is really the state of its contact with the public it serves. That intangible thing known as the company can have no relations or contact with its customers or the public except through its employees.

Graph of Public Relations Contacts

It seems advisable at the outset of any such work to analyze the entire subject—that is, to set down all of the possible contacts between the employees of any company and the public which it serves. In the accompanying chart an attempt has been made to do this. All of our employees, in some way or other, at some time, come in contact with the public, either as individuals or in groups. Upon the manner in which they make these contacts will depend whether they engender the good will or the ill will of the public toward the company.

If we are to improve our public relations, we must make a study of these contacts. As a matter of fact, such a study is entirely one of psychology. We must study the state of mind of the employee, and likewise the state of mind of the public and more particularly of our consumers—all with the end in view of bringing these two states of mind into accord. It behooves us first to bend our energies toward shaping the minds of certain employees who for want of a better name we will call "contact employees" and who are almost continually in intimate touch with the public. These have been divided into two classes:

*Read before the New England Division, N. E. L. A., at New Bedford, Mass.

First, those whose contact primarily is directly with the consumer on questions of service, yet who, through their activities when not on duty, in various ways come in contact with the public at large.

Secondly, those officials of the company whose duties bring them intimately in contact with the various powers and activities in the community or with various organizations, made up in part of the company's consumers, but including as well people who are not consumers.

While the first class most influences, perhaps, the attitude of the consumer, yet the second class is charged with so directing the energies of the first class as to make this attitude favorable. In addition, the impression which the second class makes upon the public at large has much to do with surrounding the company's business dealings with the proper atmosphere. Although naturally our efforts are first to be directed toward inducing a proper attitude toward the company on the part of its customers, we should not overlook the fact that any insidious propaganda or political agitation directed against the company is almost always influenced to a considerable degree by sections of the public who may not be consumers. The attitude of the public at large is second only in importance to the attitude of the consumer class.

Coming back to the chart, it will be seen that under certain classifications are figures which represent the number of possible service contacts per year by any one employee under each classification. These have been estimated from consideration of actual cases and in general may be held to err on the side of conservatism.

STUDY PROBLEMS OF THE CONTACT LINE

It is obvious from these figures that we should first give attention to training cashiers, meter readers, telephone operators and information clerks, directing our efforts next to collectors and salesmen, and thence down the line in the order of these possible contacts. We must therefore look forward to hiring, training and paying these contact employees, having always in mind a thorough understanding of their relative importance to the organization from the public-relations standpoint. Those whose contact necessarily is by personal interview must be taught the proper method of approach, and they must also be thoroughly impressed with the importance of their personal appearance.

Local purchasing in our own communities is always desirable, all other factors being equal. Members of the purchasing department should bear in mind that those from whom they buy locally are generally good commercial or power customers, and hence nothing should be done to nullify any of the work which other departments are doing to obtain the good will of these consumers.

In purchasing property, securing rights-of-way and pole easements and in other phases of the engineering department's work its members should likewise bear in mind that if those with whom they are dealing are not already customers, even those in the remotest country districts are likely soon to become customers.

Turning now from service contact to the other division on the chart, while the importance of many of these contacts has been recognized for years, perhaps we have not fully availed ourselves of the opportunities offered by some of them. Amicable relations with the press, city government, civic operating departments and public service commissions have always been essential. In due course the participation by company officials in the work of chambers of commerce, "Rotary," "Kiwanis" and similar clubs has been impressed upon the industry.

Perhaps we have not given so much consideration to the opportunity of promoting good will through contact by employees by means of membership in churches, fraternal, charitable and welfare organizations. Employees are not members of these organizations primarily for promoting the company's interests, yet is it possible for them to aid materially in molding public opinion favorable to the company by actively and proficiently performing their duties as members of such bodies. It is much easier for any employee to transact business with people who have gained a favorable impression of him through such association. As a company is known by the men it employs, so some of the employees of every company are known to certain sections of the public only through membership in such organizations. Any contact by employees with other elements of the public which smoothes the path of the company's business is a phase of public relations which should not be overlooked.

GET CLOSER TO THE CONTRACTOR-DEALER

Not all companies are giving sufficient attention to their relations with the electrical contractor-dealers in their territory. At present a spirit of co-operation seems to pervade the entire electrical industry, and we should take advantage of this to cultivate the good will of the contractor-dealer. It should not be forgotten that collectively the contractor-dealers in any community come into intimate contact with our consumers before we place their names on our books. We cannot afford to have any consumer's attitude toward us tainted by any wrong impressions of the company given him by a contractor-dealer.

There is much yet to be done to bring about this happier relationship. Because of past experiences and indifference, there is a lingering antipathy on the part of the utility's employees which must be overcome. They must be made to realize that the contractor-dealer is an essential part of the industry. We cannot do it all. Most of the contractors are willing to meet us, but we can well afford to go more than half way in promoting greater harmony between these two branches of the industry. The effect on our public relations will be decidedly favorable.

One great national movement offers at this time an unexcelled opportunity for company officials to foster better public relations, namely, safety work. Local safety councils, following the lead of the national organization, are rapidly making safety teaching part of the school curriculum. By active participation in this and other safety work in the community company officials get their safety ideas into the schools, and at the same time the utilities can be shown in a more favorable light to nearly every element in the community.

If the chart only initiates a more careful consideration and study of employees' relations with the public, it will have served a purpose. If it leads to a study of the consumer's state of mind, its value will be increased. Our employees' attitude toward the public may not look the same to us as to that public, and we should study the subject from both viewpoints. We should put ourselves in the place of the public and view our organization as from the outside. We may find that what from the inside we thought was the proper handling of the public is not exactly what we would wish it to be.

Limits of Electric House Heating*

Large-Scale Heating of Residences, Stores and Other Establishments in Tacoma Shows Limits Within Which Electric Heating May Compete with Other Heat in Mild Climates

By E. A. LOEW
Associate Professor of Electrical Engineering, University of Washington

THE city of Tacoma, Wash., has for a number of years had in effect a power rate which is intended to encourage consumers in the use of electrical energy for house heating and as a result has built up a considerable domestic heating load. This represents what is perhaps the largest-scale application of electrical energy to house heating in America.

Tacoma derives its power from a 20,000-kw. hydroelectric station which is owned and operated by the municipality. There is virtually no water storage. The plant was completed in 1912 at a total cost, including transmission lines and substation, of approximately $2,355,000, or about $112 per kilowatt of rated capacity.

TYPICAL ELECTRICALLY HEATED RESIDENCES WITH CONNECTED LOADS OF 9.4 KW., 26 KW. AND 11 KW. RESPECTIVELY

This low unit cost has been one of the principal factors in making possible the attractive schedule of rates which the city has maintained since the plant was completed. Because the size of the development was considerably in excess of the existing power requirements of the community, and on account of the abnormally large water supply available during the rainy season, which in that locality includes six or seven months from October to April, the city had a large percentage of surplus power. It became a question of either creating additional demand for a large block of power outside of the ordinary applications or else wasting the surplus. The domestic heating load offered possibilities of large additional loads if rates were established which would make it economically possible. Such a rate must be low enough to encourage the use of considerable electrical energy for heating, and still high enough to maintain coal and wood in a strongly competitive position.

The domestic rates for power fall in two classes:

1. *Combination Light and Cooking Rates.*—Applicable to residences, flats and apartments. Under this rate a charge of 5 cents per kilowatt-hour is made for a monthly kilowatt-hour consumption up to a certain minimum known as the "lighting base" kilowatt-hour. This minimum depends upon the size of the residence or apartment, but a fair average figure is 33 kw.-hr. All energy in excess of the lighting base kilowatt-hour is billed at 1 cent per kilowatt-hour. Under this rate the average monthly bill of customers having range, lights and the usual appliances is about $2.50.

2. *Heating Rate.*—For customers having electric house-heating equipment. A minimum charge of $9 per kilowatt of maximum demand per year is made and a regular energy charge of ½ cent per kilowatt-hour. The customer is required to have a separate meter on his heating load in order to take advantage of this rate and is permitted to use this service only on air-heating and water-heating equipment. The purpose of the minimum charge is to reduce demand as much as possible.

The ½-cent rate covering the use of energy for house heating has been in effect since 1914. A small number of consumers took advantage of this rate from the time of its first introduction. For the most part the electric heat was used as an auxiliary to heating plants of one kind or another which were already installed in the residences. At the prices of coal and wood which then

TABLE I—AVERAGE SPECIFIC ENERGY CONSUMPTION

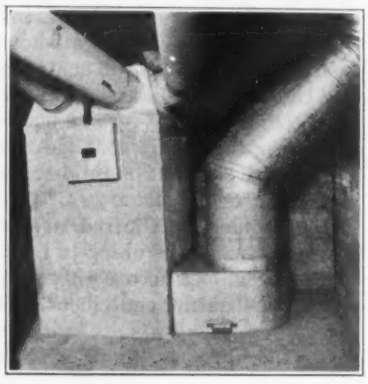
For nineteen consumers having furnace plants, based on their December consumption and the percentages given in the table.

Month	Outdoor Temp., in Deg. Fahr.: Average Monthly Temperature	Outdoor Temp., in Deg. Fahr.: 68 Deg. Fahr. Minus Average Monthly Temperature	Average Estimated Kw.-hr. Consumption per Furnace Plant	Per Cent Yearly Total	Average Kw.-hr. Per Month Deg. Fahr. Below 68 Deg.
January	39.5	28.5	4,850	14.1	170
February	39.8	28.2	4,650	13.5	165
March	44.4	23.6	4,550	13.2	193
April	45.6	22.4	3,995	11.6	178
May	51.8	16.2	2,410	7.0	149
June	58.6	9.4	1,760	5.1	187
July	64.6	3.4	860	2.5	252
August	64.6	3.4	344	1.0	101
September	58.0	10.0	963	2.8	96.3
October	49.8	16.2	2,125	6.3	117
November	46.1	21.9	3,580	10.4	163
December	42.6	25.4	4,300	12.5	169
Average	50.4	17.55	2,860		162

*Complete results of investigation contained in Bulletin No. 15, University of Washington, Engineering Experiment Station, entitled "Electric Heating of Residences."

prevailed, electric heating, even at this low rate, was considerably more expensive than coal or wood if used to supply the full heating requirements.

At the close of the year 1918 only 378 consumers had taken advantage of the ½-cent heating rate. Up to Dec. 31, 1919, 547 consumers had begun to use electric heat and were supplying either part or all of their heating requirements in this way. Of these 139, or 25.5 per cent of the total, used this service throughout the entire twelve-month period. Thirty-six of the 139 had a connected load of less than 4 kw., and the remaining 103, or 19 per cent of all the heating consumers, had an average connected load of 8.17 kw. It is probably safe to assume that no consumer having a connected load of 4 kw. or less could get along comfortably throughout the winter in even a small house without additional heating facilities, while an average connected load of 8.17 kw. would serve to heat the average house, assisted perhaps, by a little additional heat from stove, furnace or fireplace during the most severe winter weather. The 103 consumers having an average demand of 8.17 kw. roughly represent those whose entire heating requirements during 1919 were taken care of electrically, whereas the remaining forty-four used auxiliary heating apparatus to a greater or less extent.



EXAMPLES OF HOT-AIR ELECTRIC FURNACES

INCREASING LOAD

The heating business of 1920 showed considerable increase over that of 1919. The total number of consumers increased from 547 to 925, or approximately 69 per cent; the number of consumers using energy the full year from 139 to 423, or a little over 300 per cent; the number using 4 kw. or over the full year from 103 to 305, or about 300 per cent, and the total connected load from 3,625 kw. to 6,104 kw., an increase of 168 per cent. The tendency of the old consumers to continue to use electric heating throughout the year after once having experienced its advantages, as well as to reduce the amount of auxiliary heating, is indicated by the fact that while the total number of consumers increased by 69 per cent, those using electric heat throughout the year increased by 300 per cent, or four times as fast. Those using over 4 kw. throughout the year and heating more or less wholly by the electric method increased in a similar ratio.

A point of interest is the fact that the average rate per kilowatt-hour sold increased from 0.52 cent to 0.557 cent, or 1.1 per cent, the schedule of rates remaining unchanged. The increase of the average selling price above the ½-cent rate results from the operation of the nine-dollar minimum. The tendency is to install sufficient heater capacity to take care of the coldest weather conditions. This often leads to the installation of heater capacity considerably in excess of that required for average winter weather and results in the minimum charge for the year exceeding the charge based on the straight kilowatt-hour consumption.

Among the business consumers are included numerous small stores and shops in which often only part of the space is heated, or perhaps only sufficient heat is supplied to take the chill off the room, as in grocery stores, etc. In other places of business, such as ware-

TABLE III—ELECTRIC HEATING IN TACOMA IN 1920

	Class of Customer			
	Residence	Apartment	Business and Miscellaneous	Total
Number of customers	795, or 86%	54, or 5.8%	76, or 8.2%	925
Number of full-year customers	377, or 89%	15, or 3.6%	31, or 7.4%	423
Total kw.-hr. consumption	7,207,600, or 81.3%	396,360, or 4.5%	1,256,000, or 14.2%	8,860,000
Average kw.-hr. consumption per customer	9,075	7,340	16,500	8,580
Total kw. connected load	5,141	307	656	6,104
Average kw. connected load per customer	6.47	5.68	8.63	6.60
Total income	$39,812, or 80.6%	$2,298, or 4.6%	$7,290, or 14.8%	$49,400
Average annual income per customer	$50.10	$42.50	$96.00	$53.00
Average annual income per kw. connected load	$7.90	$7.50	$11.10	$8.09
Average rate per kw.-hr. sold	$0.0552	$0.0579	$0.0581	$0.0557
Number customers using 4 kw. or more a full year	271	10	24	305
Total connected load of full-year customers of 4 kw. or over	2,274 kw.	75.5 kw.	236 kw.	2,585.5 kw.
Average connected load of customers using 4 kw. or over	8.38 kw.	7.55 kw.	984 kw.	8.48 kw.
Average income for year per customer using 4 kw. or over	$81.00	$92.00	$132.00	.....
Total income from customers using 4 kw. over a full year	$21,973.00	$919.87	$3,168.87	$26,061.75

TABLE II—MONTH-BY-MONTH ENERGY CONSUMPTION FOR HOUSE HEATING BY RESIDENCE CONSUMERS IN 1920

	375 Full-Year Residence Consumers; Average Connected Load 6.28 Kw.				278 Full-Year Residence and Apartment Consumers Using 4 Kw. or Over; Average Connected Load 7.80 Kw.				Consumption of Ten Typical Full-Year Consumers Who Use Some Auxiliary Heat; Average Connected Load 7.85 Kw.				Consumption of Seven Consumers Using Hot-Air Electric Furnace Throughout the Year; Average Connected Load 10.85 Kw.			
	Kw.-hr. Consumption		Total	Cost	Kw.-hr. Consumption		Total	Cost	Kw.-hr. Consumption		Total	Cost	Kw.-hr. Consumption		Total	Cost
Month	Total	Average	Per Cent Yearly	Actual Average	Total	Average	Per Cent Yearly	Actual Average	Total	Average	Per Cent Yearly	Actual Average	Total	Average	Per Cent Yearly	Actual Average
January	669,000	1,785	14.1	$9.81	570,800	2,070	13.9	$11.35	36,392	2,020	14.8	$11.65	29,200	4,170	14.6	$21.45
February	643,000	1,715	13.5	9.30	565,600	2,050	13.8	11.30	31,167	1,730	12.7	10.00	27,700	3,960	13.9	20.35
March	625,000	1,665	13.2	9.19	530,200	1,920	12.9	10.50	33,085	1,836	13.4	10.55	28,980	4,140	14.5	21.30
April	550,000	1,467	11.6	8.07	479,600	1,740	11.7	9.50	28,560	1,580	11.6	9.13	24,232	3,460	12.2	17.80
May	332,000	885	7.0	4.87	282,900	1,025	6.9	5.60	17,408	966	7.1	5.60	12,952	1,850	6.5	9.50
June	241,000	642	5.1	3.55	212,900	772	5.2	4.60	17,158	953	7.0	5.51	8,965	1,280	4.5	6.60
July	119,000	317	2.5	1.74	105,200	380	2.6	2.10	4,750	264	1.9	1.50	2,885	410	1.4	2.10
August	49,500	132	1.0	0.70	43,800	150	1.0	0.90	1,143	63	0.5	0.40	3,982	570	2.0	2.95
September	132,000	352	2.8	1.95	109,500	396	2.7	2.20	5,263	292	2.1	1.65	4,145	590	2.1	3.05
October	303,000	808	6.4	4.45	257,600	932	6.3	5.10	15,199	845	6.2	4.90	11,653	1,660	5.7	8.55
November	492,500	1,310	10.3	7.17	422,000	1,530	10.3	8.40	23,806	1,433	10.5	8.25	20,235	2,890	10.1	14.85
December	593,600	1,582	12.5	8.70	522,100	1,890	12.7	10.30	29,910	1,660	12.2	9.60	24,710	3,530	12.4	18.15
Totals	4,749,700	12,660	100	$69.50	4,102,200	14,864	100	$81.85	245,841	13,642	100	$78.75	199,639	28,510	100	$146.65*

* Including cost of water for hot water supply.

houses in particular, heat is supplied for the office rooms only. A few of the business and miscellaneous customers are large consumers. These include theaters, banks and churches. The largest single consumer during 1920 was a theater having a connected load of 152 kw., consuming a total of 291,840 kw.-hr. for the year and costing $1,459.20.

In many cases some additional heat is supplied by means of a kitchen range or a fireplace during the coldest weather. The costs of electrical energy given, therefore, probably do not represent accurately the full amounts of the average heating bill for the customers involved. However, this error is partly compensated for by the fact that a considerable number of the consumers have electrical water heaters connected to the heating circuit.

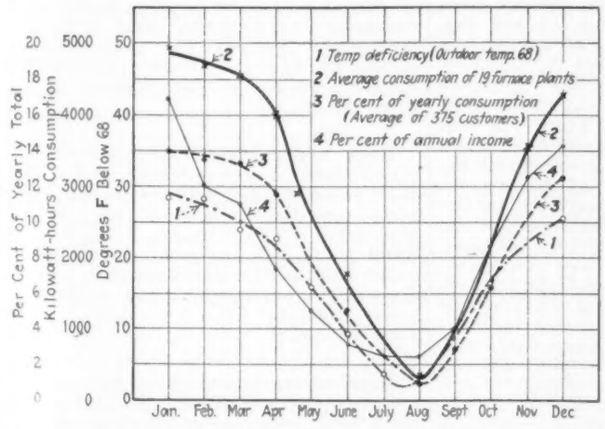
TABLE IV—ANALYSIS OF HEATING LOAD IN 1919

Number of customers Dec. 31, 1919	547
Income from all customers (378 for only part of year)	$19,488.25
Total connected load of all customers, Dec. 31, 1919, kw.	3,625
Number of customers served for full year	139
Income from customers served for full year	$9,268.40
Total connected load of full-year customers, kw.	923
Average annual income per kilowatt of load	$10.00
Consumption by full-year customers, kw.-hr.	1,778,238
Average rate per kw.-hr.	$0.0052
Number of customers using over 4 kw. a full year	103
Total connected load (kw.) of full-year customers over 4 kw.	842
Average load (kw.) of customers using over 4 kw.	8.17
Average load of all 547 customers, kw.	6.65

It is a noteworthy fact that these customers paid an average of $78.75 per year each for 13,642 kw.-hr., or at the rate of 0.576 cent per kilowatt-hour. Had they reduced their connected load sufficiently to take advantage of the ½-cent rate without penalty, the average bill would have been only $68.71.

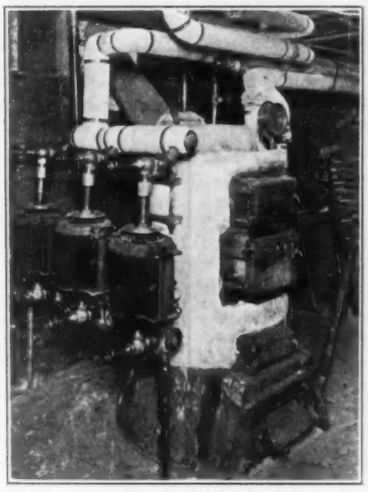
CONSUMPTION BY ELECTRIC FURNACE PLANTS

A limited number of consumers, representing the highest development in the complete electrification of the home, are using hot-air electric furnaces. Nearly all consumers of this class not only have their homes completely electrified, but have eliminated portable electric heaters as well and have substituted in their place a central heating plant, or electric furnace, located in the basement, which supplies either hot water or hot air to the various rooms in much the same way as does the ordinary hot-water or hot-air coal-burning plant. At the present time there are installed in Tacoma residences about fifty such plants. Of these the great majority are hot-air plants, a few use hot water, and a few use electrically generated low-pressure steam. When


Per Cent of Yearly Total
Kilowatt-hours Consumption
Degrees F Below 68
1 Temp deficiency (Outdoor temp. 68)
2 Average consumption of 19 furnace plants
3 Per cent of yearly consumption (Average of 375 customers)
4 Per cent of annual income
Jan. Feb. Mar Apr May June July Aug Sept Oct Nov Dec

RELATION OF DEMAND AND ENERGY CONSUMPTION REQUIRED FOR HOUSE HEATING TO OUTSIDE TEMPERATURES

comparing the consumption of these customers with that of the average consumer, the fact must not be overlooked that these installations are usually found in the homes of those whose houses are above the average in size and who can afford to pay something for extra comforts and convenience. It is perhaps fair to assume that their consumption is considerably above that demanded by the average home where strict economy is necessary, for in addition to the loss of heat by radiation from the furnace and piping in the basement, it is probably true also that lack of close supervision often results in the use of more energy than is required for comfort. Furthermore, these usually include an electric water heater connected to the same meter with the furnace circuit, of an average capacity of perhaps 3 kw., the consumption of which is included in the values given in the table.



ELECTRIC INDUCTION-TYPE HEATERS USED INTERCHANGEABLY WITH HOT-WATER FURNACE

The largest single residence consumer occupied a fourteen-room house, and with a connected load of 39.3 kw. consumed 82,400 kw.-hr. during 1920, costing $412. Radiant-type heaters distributed throughout the house were used for the most part, although one or two hot-water induction-type heaters attached directly to hot-water radiators were also employed. The hot-water supply for the house was furnished by electric heaters, while cooking was done by gas.

INFLUENCE OF OUTDOOR TEMPERATURE ON POWER CONSUMPTION

An indoor temperature of 68 deg. Fahr. is assumed as representing the average indoor temperature of a heated house throughout the year. The month-by-month average outdoor temperatures for Tacoma, as recorded by the United States Weather Bureau, are shown in the table of average specific energy consumption, the temperature differences between the average monthly outdoor temperature and 68 deg. Fahr. and the month-by-month consumption of 375 full-year consumers being expressed in per cent of their total yearly consumption. The month-by-month estimated consumption is based upon the actual December consumption and the percentages given in column 5.

One of the illustrations clearly shows how closely the energy consumption follows the outdoor temperature. By dividing the monthly energy consumption by the average difference in temperature between out of doors and 68 deg. Fahr. for the same month, a figure is obtained which represents the kilowatt-hours per month per Fahrenheit degree temperature below 68 deg. for a given class of consumers. This figure is fairly constant for all months except the summer months, during which the energy consumption is small, and is of value when making comparisons of energy consumption.

Twenty-one Observations and Conclusions Regarding Transformer Operation on Temperature Basis

[1]

Transformers in general are designed to operate well within the limits of permissible temperature rise specified by the Standardization Rules of the American Institute of Electrical Engineers (55 deg. C.). There thus exists a measurable amount of capacity available for use if it can be intelligently employed.

[2]

Certain makes of transformers are much more liberally designed than others, there being a large amount of capacity available in such product in excess of normal rating before reaching permissible maximum operating temperatures.

[3]

The conditions described in [1] and [2] are particularly noticeable in certain sizes of transformers where changes in design due to changes in capacity have resulted in more liberal ratings for specific sizes, owing to lower temperature rise. Increased capacities available under conditions noted in [1], [2] and [3] are tremendously increased with reduction in ambient temperature as shown in Figs. 2, 4, 5, 6 and 7.

[4]

Transformer capacity required for a given system load and losses involved in operation may be reduced, if transformers are operated on a temperature basis and protected by indicators.

[5]

Transformers may be safely operated at substantial overloads for extended periods to meet varying conditions of demand, if protected by indicators.

[6]

Increased transformer capacity is available (owing to use of indicators) of one value for units operating at high load factor and of much greater value when units are operating under a low load factor or at variable loads.

[7]

Transformer loading as shown by ammeters, voltmeters or wattmeters is of little value in determining permissible loading. Temperature observations constitute only accurate and efficient method of limiting loading.

[8]

Determination of temperature rise of transformers in service by "resistance method" is impracticable, since service must be interrupted to conduct tests. "Thermometer method" is the only practicable method.

[9]

The rule of the A. I. E. E. which prohibits adoption of increase in temperature use over that specified as permissible (55 deg. C.), even though ambient temperature is lower than 40 deg. C., is inconsistent with good operating practice. To comply literally with this rule would mean a heavy loss in capacity otherwise available.

[10]

The rated capacity of transformers may be increased when ambient temperature is lower than 40 deg. C. if the oil temperature is checked by suitable temperature indicators.

[11]

Increase in capacity with decrease in ambient temperature from 40 deg. C. varies almost directly with change in temperature, viz., for every degree Centigrade which the ambient temperature increases or decreases the capacity of a transformer is decreased or increased approximately 1 per cent, with coil temperature not exceeding 105 deg. C.

[12]

Regulation of transformers not appreciably affected by loading is equivalent to from 150 per cent to 175 per cent of rating if the load is of high power factor. (See Fig. 3.)

[13]

Successful operation of transformers on a temperature basis is entirely dependent upon accurate observation of oil temperature. To be effective, oil temperature must be measured at a point directly over the transformer coils and as close to them as possible.

[14]

Oil temperatures of 176 deg. to 194 deg. Fahr. (80 deg. to 90 deg. C.) are entirely safe and satisfactory for transformers of 7.5 kva. and over when operated in ambient temperatures from 0 deg. to 104 deg. Fahr. (— 18 deg. to 40 deg. C.) is measured as indicated in the preceding paragraph. For units of less capacity, oil temperatures of 159 deg. to 176 deg. Fahr. (70 deg. to 80 deg. C.) may be safely adopted. For those who are conservatively inclined the adoption of 85 deg. C. and 75 deg. C. respectively as the maximum oil temperatures for the two groups of transformers may offer a satisfactory basis for operation. In general for ambient temperatures lower than 0 deg. Fahr. (— 18 deg. C.) oil temperatures lower than the above should be adopted if loading can exceed 175 per cent of rating.

[15]

Most efficient results are obtained by use of a two-stop indicator. With warning signal set as a conservative value, 167 deg. to 176 deg. Fahr. (75 deg. to 80 deg. C.) and danger signal set at 185 deg. to 194 deg. Fahr. (85 deg. to 90 deg. C.) there exists a safety zone which is especially valuable in determining the procedure to be followed in controlling transformer loading. Occasional operation of the warning signal gives information of some unusual use of service which may be disregarded at least until the danger signal is displayed. This feature should prove exceedingly valuable in hot climates where the margin of overload is limited as shown by Fig. 4. In cold climates the warning signal may be interpreted as the danger signal during exceedingly cold periods, thus meeting all operating conditions where recognition of very low ambient temperatures is desirable.

[16]

Allowance of 27 deg. Fahr. (15 deg. C.) for "hot-spot" correction, applicable to the "thermometer method" of temperature measurement, as provided in the Standardization Rules, has been found to be too liberal in some transformers. Temperature gradient from exterior to interior of windings in large transformers is frequently as low as 9 deg. Fahr. (5 deg. C.) and rarely reaches 27 deg. Fahr. (15 deg. C.) in transformers of any capacity now in general use. Adherence to the A. I. E. E. rule leaves a substantial margin of safety over that assumed from test data recorded in Figs. 4 to 7.

[17]

Owing to generally insufficient ventilation, transformers of large capacity installed in manholes are operated under unfavorable conditions as compared with pole-type units. Temperature indicators provide a constant check on such conditions.

[18]

The condition of transformers operating under variable load is reflected in oil temperature. Experience indicates that the heating effect of overloads of short duration is overestimated or the cooling effect of intermediate periods is underestimated, and that transformers of less capacity would be satisfactory in many locations.

[19]

High temperatures developed in transformers due to operation at less than rated voltage will be immediately recorded by an indicator, if expressive. Transformers rated at 2,400 volts, if operated at 2,200 volts, will develop approximately 10 per cent higher temperatures at the lower voltage, when operating at rated capacity.

[20]

High temperatures occurring in transformers regardless of loading conditions, owing to insufficient oil, slow circulation due to heavy or thickened oil or clogged oil ducts, are immediately detected by indicators.

[21]

Abnormal temperature developed in individual transformers operating in multiple to supply a network and due to poor distribution of load or failure of one transformer to carry its proper share of load because of internal defects, loose connections or blown fuses is immediately recorded by an indicator.

Operating Distribution Transformers on a Temperature Basis

Diversity Factor an Unreliable Index of Service Requirements—Use of Indicating Equipment Enables Operation at Higher Temperature to Be Safely Continued with Marked Economic Advantages

By L. L. ELDEN

Electrical Engineer Edison Electric Illuminating Company of Boston

STUDIES of distribution-transformer loading on the Boston Edison system have demonstrated that the temperature basis is more effective than the diversity factor in determining service rating. These investigations began several years ago and include both field and laboratory observations. The rapid increase in the use of appliances, introduction of high-efficiency lamps, underloaded motors and marked variations in average maximum coincident demands have in large measure upset former indices of determining transformer capacity. Under present conditions it not infrequently happens that transformers both too large and too small are selected for a given service. Such installations are both unsatisfactory and uneconomical. In one case a change must be made to reduce capacity and daily losses to an economical basis, and in the other the capacity must be increased to prevent failure or destruction of the unit. Both operations are costly in labor if generally required.

BENEFITS OF TEMPERATURE BASIS

Analyses of the loading conditions of individual transformers have repeatedly demonstrated the fact that if the performance of every transformer could be controlled on the same basis as generating and substation apparatus—that is, on a temperature basis—a substantial reduction in plant costs and operating expenses could be effected. Reduction in plant costs would result from a decrease in the capacity of transformers required for a given load. While this would have to be gradual on an established system, it would be effective in influencing new construction and would finally reduce the entire system to a more economical basis by gradually increasing the loading of all transformers.

Reduction of operating costs would result from lower core losses, with elimination of many changes in transformers to meet increased demands for service, and a marked reduction in the testing costs usually considered necessary to check loadings.

TABLE I—NUMBER, RATING AND DUTY OF DISTRIBUTION TRANSFORMERS ON BOSTON EDISON SYSTEM IN 1921

	No. Used	Rating (Kva.)	Total Rating (Kva.)	Service
Single-phase..	6,215	0.6—100	56,245	Single-phase lighting, small power and appliances
Three-phase..	1,294	5.0—300	52,208	Three-phase power service
Total.....	7,509	.....	108,453	

	Kw.-hr.
Total sales of energy through above transformers.....	78,000,000
Core losses, approximately, total.....	9,500,000
Total investment in transformers, approximately.....	$1,000,000

The results obtained from experiments in temperature operation initially conducted on isolated transformers of relatively large capacity (30 kva. to 50 kva.) were so uniformly satisfactory that this method of operation was extended to selected groups of transformers with similar results. From these studies has come finally the adoption of the temperature method of operation for the entire system for units of 5 kva. and over which serve more than one customer.

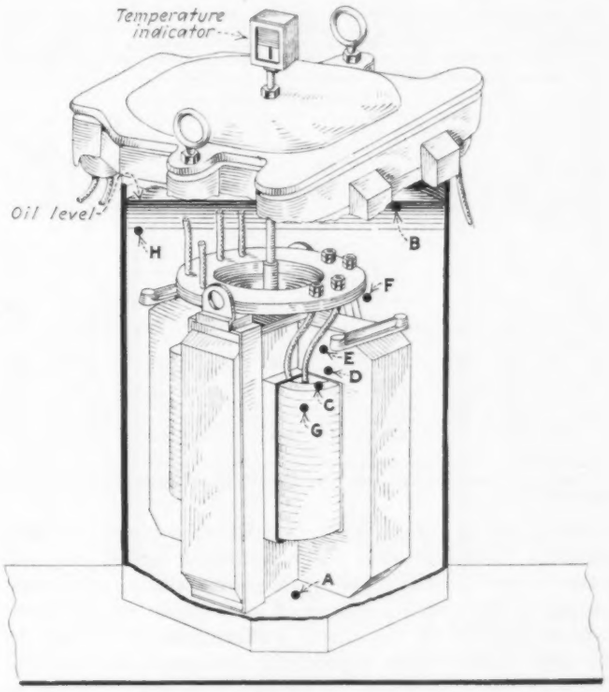


FIG. 1—POSITIONS AT WHICH TEMPERATURE OBSERVATIONS WERE MADE

Conservative estimates of the economies which can be effected by operating the system on a temperature basis indicate a reduction of at least 10 per cent in transformer capacity and a similar reduction in annual losses. Including elimination of costs for changing transformers and for testing, the total yearly savings may easily reach $30,000 in the near future.

In developing a standard to be employed generally in operating transformers on a temperature basis, it was found desirable to measure the actual temperatures developed within units as usually installed and operated. An exhaustive study of oil and coil temperatures in all types and sizes of transformers was undertaken in the field, from which much valuable data were obtained on the effects of ambient temperatures and loading upon

oil and coil temperatures. These studies included the effect of seasonal variations in temperature upon the internal temperatures of transformers as developed under various loading conditions. Some of these variations in loading are indicated in Table II.

It developed that if the temperature rise of the windings was to be gaged by the rise in oil temperature, there was only a limited area of the oil body within which the oil temperature consistently followed the changes in coil temperature due to load changes or other causes. Tests made at *A* (Fig. 1) clearly showed that the oil temperature at that point did not vary consistently with coil temperatures, and these also varied widely with different sizes and types of transformers. At this location the temperatures were also measurably affected by the use of oils of different densities, as well as by the different quantities used by the several manufacturers in their respective designs.

Temperatures at *B*, if taken in the center of the transformer, were reasonably consistent except at low ambient temperatures. Temperatures at *H* or any point close to the case were particularly unreliable owing to the varying effects of sun, shade and wind on different parts of the case. Differences of 10 deg. to 15 deg. Fahr. were repeatedly observed on opposite sides of the case when the transformer was exposed to cold winds or partially exposed to an unusually hot sun. Temperatures at *G* and *C* gave coil temperatures which consistently followed loading conditions, and when corrected by adding 27 deg. Fahr. (15 deg. C.) to observed temperatures, in accordance with the Standardization Rules of the American Institute of Electrical Engineers, were assumed to indicate approximately any "hot-spot" temperature within the windings.

Temperatures at *D*, ½ in. (12.7 mm.) above the coils, at *E*, 2 in. (50.8 mm.) above, and at *F*, approximately 4 in (101 mm.) above the coils, were found to vary not over 3.6 deg. Fahr. (2 deg. C.) from each other and consistently to follow those observed at *G* and *C* at all times regardless of changes in ambient temperature or loading conditions within reasonable limits.

As a result of these tests it was determined that the only reliable location in which to measure oil temperatures as a basis for determining transformer loading conditions was in a position directly over the coils and in close proximity thereto.

TABLE II—COMPARISON OF AVERAGE DEMANDS OF VARIOUS CLASSES OF CONSUMERS

Group 1—First-class and second-class single houses, apartments and stores in community centers in suburban districts; group 2—first-class single and two-apartment houses in residential districts; group 3—second-class two-apartment and three-apartment houses in residential districts; group 4—same as group 1.

Group No.	Rating of Transformers (Kva.)	Consumers Connected	Connected Load (Kw.) Light	Power	Heat	Miscellaneous	Total	Maximum Load by Test (Kw.)	Average Demand per Consumer (Watts)
1	10	72	66.6	4.7	...	...	71.3	6.32	87
	10	51	63.8	3.1	0	0	63.9	15.06	295
	10	116	89.2	0.6	0	0	89.8	13.8	110
2	15	18	57.6	2.6	27.8	0	88.0	11.5	638
	15	73	95.6	2.3	0	0	97.9	18.05	247
	15	78	89.9	0.3	0.5	0	90.7	13.9	178
3	20	18	18	0	19	0	37	14.95	830
	20	32	38	0	61	0	99	12.19	380
	20	25	27.9	0	0	0	27.9	4.37	174
4	60	192	235	4.7	1.8	0	241.5	63.25	329
	60	452	415.4	14.2	15.8	6.0	451.4	70.15	158
	90	431	447	49	4.9	5.4	506.3	122.13	283

*Company records of connected load do not include appliances rated at less than 660 watts.

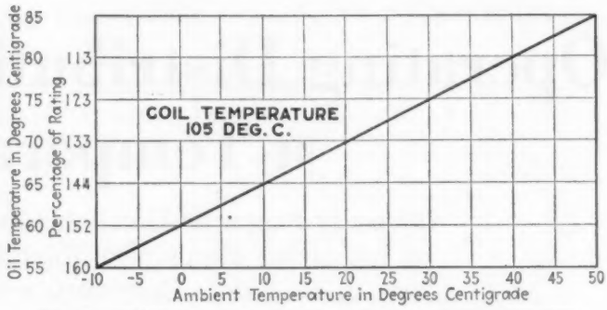


FIG. 2—TRANSFORMER RATING AND OIL TEMPERATURES DEVELOPED AT VARIOUS AMBIENT TEMPERATURES

During the tests transformers were operated singly and in banks, serving every possible form of business. The tests were extended over a long period to permit the full effect of seasonal changes in climate and loading to be carefully checked. Variations in daily temperatures between night and day were found to have a material effect upon transformer temperatures and capacity. Observations in the field were finally checked by laboratory tests on selected transformers, the results of which are shown in Figs. 4, 5, 6 and 7.

Summarizing some of the important operating conditions observed during a survey of the system, the following were noted as typical causes of transformer failures attributable to high temperatures:

Insufficient ventilation of manholes.

Deficiency in oil due to leakage or evaporation.

Reduced circulation due to sludging of oil and clogging of oil ducts.

Loads of low power-factor.

Unbalanced loads on three-wire mains.

Unequal distribution of load between transformers in networks due to poor regulation of certain transformers, loose connections in secondary mains, the blowing of primary fuses and other conditions incidental to multiple operation of transformers.

A considerable number of transformers were found to be regularly operating at substantial overloads, as illustrated by Fig. 3, which clearly indicates the possibilities under the temperature method of operation.

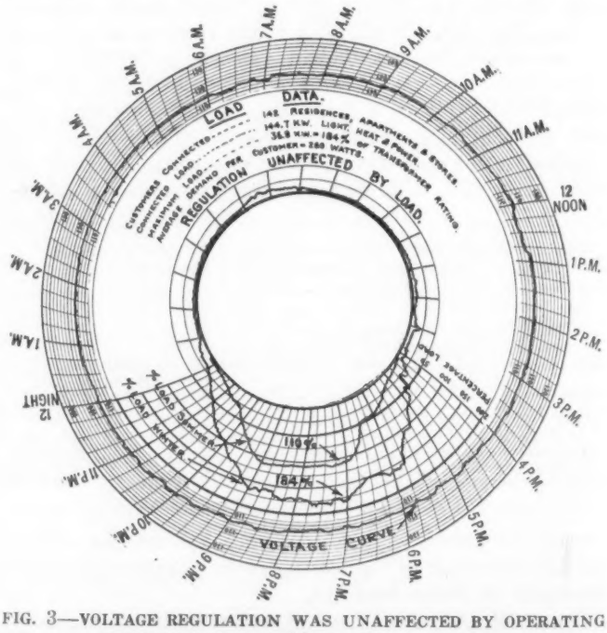


FIG. 3—VOLTAGE REGULATION WAS UNAFFECTED BY OPERATING TRANSFORMERS AT 84 PER CENT OVERLOAD

The figure further indicates the danger of relying on the secondary voltage as an indication of overload.

In considering the temperature to which transformer windings may safely be subjected, we may refer to the A. I. E. E. Standardization Rules, which provide as follows:

The limiting "hottest spot" temperature for class A insulation shall be 221 deg. Fahr. (105 deg. C.).

The limiting observable temperature rise for transformers using class A insulation shall be 131 deg. Fahr. (55 deg. C.) from a standard ambient temperature of 104 deg. Fahr. (40 deg. C.) in air.

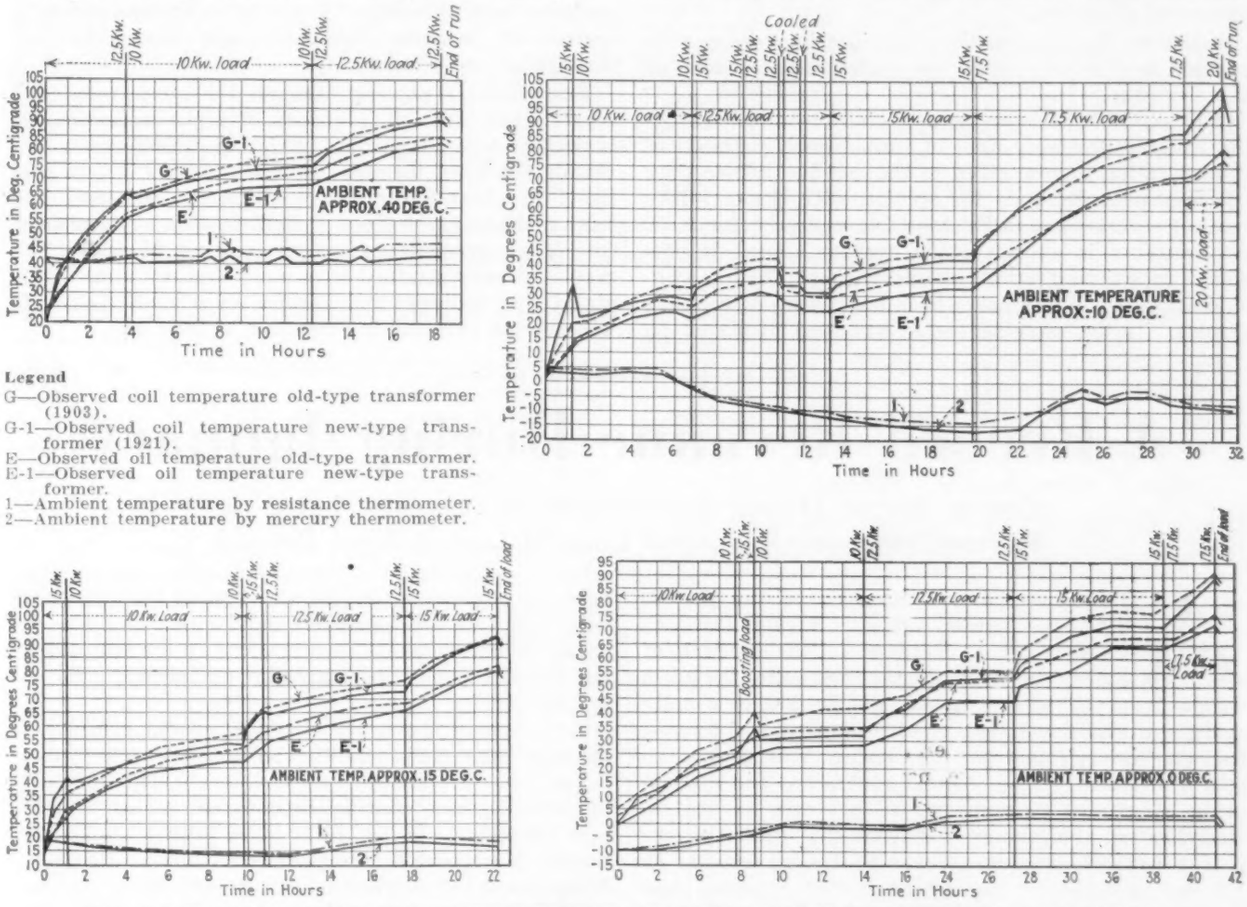
Temperature of transformer windings shall always be obtained by method 2 (resistance method) but with the results thus obtained checked wherever possible by method 1 (thermometer method). A correction factor of 18 deg. Fahr. (10 deg. C.) shall be added to temperatures determined by method 2 and 27 degs. Fahr. (15 deg. C.) to those determined by method 1 to correct for "hot spot" temperatures in windings. No increase in limiting observable temperature rise specified, 131 deg. Fahr. (55 deg. C.), shall be permitted when ambient temperature is less than 104 deg. Fahr. (40 deg. C.). Limiting observable temperature of oil in which windings are immersed shall in no part exceed 194 deg. Fahr. (90 deg. C.).

Inquiry of manufacturers as to the maximum oil temperature which would be approved for their product was unproductive of definite results. Temperatures varying from 176 deg. to 185 deg. Fahr. (80 deg. to 85 deg. C.) were suggested for medium and large-capacity units and lower temperatures for small units. Great stress has been laid upon the necessity for limiting oil temperatures to materially lower values when ambient temperatures are very low, although happily this proves to be entirely uncalled for even for very high loading values in temperatures as low as 0 deg. Fahr. (—18 deg. C.). So far as is known, the relation between the oil and coil temperatures at various ambient temperatures as developed by one manufacturer and shown in Fig. 2 is the only authoritative information on this general subject which is available even at this late day. This curve clearly shows the increase in capacity which becomes available in ambient temperatures lower than 40 deg. C. and in some measure confirms the results of independent observations.

From the experience gained in the field in the study of transformer operation it appeared that a suitable device for practical use in measuring and indicating the temperature of oil in transformers in service should comply as far as possible with the following specifications:

A. It should display a cautionary signal when a predetermined oil temperature is reached, to be followed by a danger signal when a higher or critical oil temperature value is attained.

B. The heat-actuating element should be extremely ac-



Legend

G—Observed coil temperature old-type transformer (1903).
G-1—Observed coil temperature new-type transformer (1921).
E—Observed oil temperature old-type transformer.
E-1—Observed oil temperature new-type transformer.
1—Ambient temperature by resistance thermometer.
2—Ambient temperature by mercury thermometer.

FIGS. 4, 5, 6 AND 7—OBSERVED TEMPERATURE RISE IN OIL AND WINDINGS OF 10-KW. DISTRIBUTION TRANSFORMERS OPERATING AT DIFFERENT LOADS AND AMBIENT TEMPERATURES

The lower the ambient temperature the larger the load which a given transformer can carry without overheating. The accompanying curves, obtained by subjecting units to successively higher loads after constant temperature had been reached at any one, show the excess rating which can be obtained from a transformer when the ambient temperature is dropped from 40 deg. C. to —10 deg. C. Note the rapid decrease in coil temperature with reduction in load. In all cases the capacity available is in excess of that indicated by Fig. 2, even where the coil temperature is corrected for "hot spots" by adding 15 deg. C. The coil and oil temperatures were obtained from measurements conducted with resistance thermometers.

curate in measuring temperatures and capable of adjustment over a moderate range of temperature. Calibration to be unaffected by extreme changes in temperature.

C. The device should be mechanically simple and require the minimum amount of maintenance.

D. Weatherproof, oil-proof, bug-proof and fool-proof.

E. Readily visible from a distance.

F. Suitable for use on pole or subway transformers and so made that it can be installed without causing new opportunities for oil leaks or breaking gaskets or seals under transformer covers. The indicator should be capable of removal after installation without disturbing the operation of the transformer.

G. Equipped with resetting device easily operated by linemen or inspectors.

Indicators based upon these specifications are now in regular field service upon the distribution system of this company.

The use of indicators has materially modified operating methods formerly used in transformer installation. Consideration is now given to the average rather than the maximum demands for service, with the certainty that the overload capacity available will care for most requirements in excess of the average. Load is now added to existing transformers without further consideration if the indicators have not displayed warning signals. If the warning signal has been displayed on occasions, tests may be made to determine the desirability of adding more load; but in general the load is added and the operation of the indicator awaited before increasing transformer capacity.

Inspection of indicators is automatically rendered at little or no expense through daily reports of inspectors and troublemen whose duties require their presence in all parts of the system. Where transformers are installed in vaults or remote locations not under regular company observation, the co-operation of the consumer is obtained, and he reports by mail any operation of an indicator. Under such conditions, with all transformers equipped with indicators, the operation of the company's system will be under observation and control the year through as never before.

Transformers passing through the stock room and repair shop are all prepared for the reception of indicators when required. Existing transformers are readily equipped through the use of spare covers prepared in advance for the reception of indicators and later exchanged for those in field service. The present cost of equipping transformers is about $6 each. The results already attained have more than warranted this outlay and indicate that returns even more favorable will develop through an extension of their use.

A Record Revenue During January

Central Station Output Decreases Below December, but Gross Revenue Increases—Industrial Load Is Largest Since October

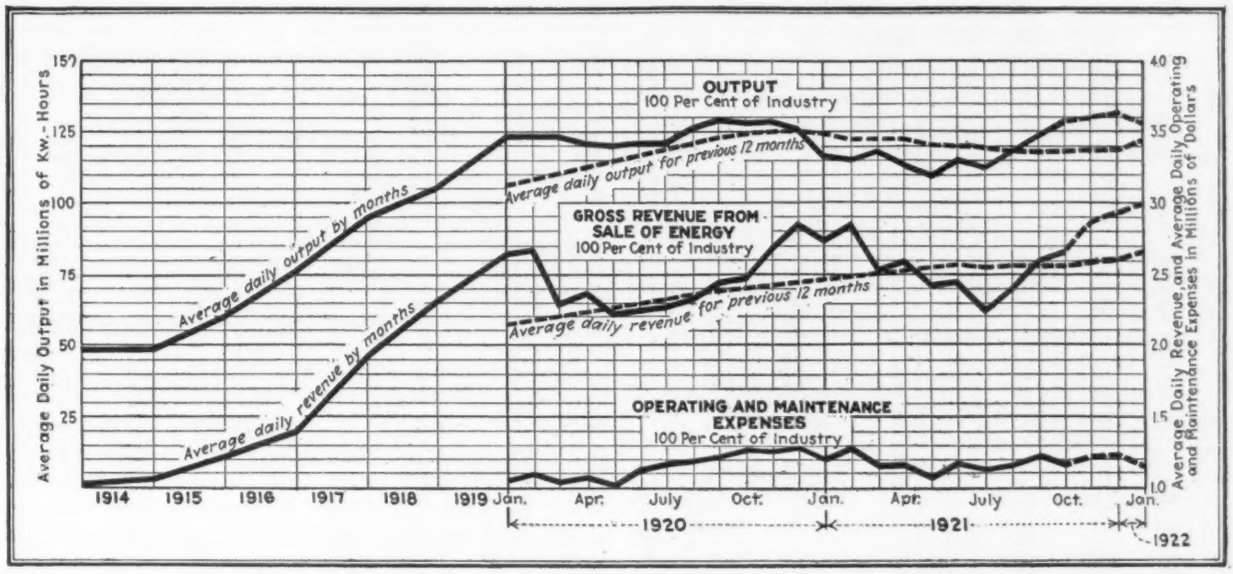
ANOTHER record was hung up by the electric light and power industry during January. In spite of a decrease in the amount of energy consumed during the month, the gross income from sale of energy was $92,700,000, or a daily average of $2,993,000, both of which were record figures. Reports received by the ELECTRICAL WORLD for the month of January from central generating and distributing companies representing 78 per cent of the installed rating of the country indicate that while the output of 3,988,000,000 kw.-hr. was 53,000,000 kw.-hr., or 1.3 per cent, below the record output reported last December, yet it was 265,000,000 kw.-hr., or 7.1 per cent, in excess of that reported for January, 1921. In addition, the operating and maintenance expenses during January were 2.7 per cent below those of January, 1921. From an economic viewpoint, therefore, the January returns are most encouraging to the electric light and power industry, especially when the industry is compared with other primary industries which are still unable to report favorable operations or are just emerging from a period of markedly curtailed production activity.

As indicated above, the electrical energy sold during January was only slightly below that sold during December. Government figures indicate that in general industrial activity during January showed an increase over December. Out of forty-three primary industries, twenty-five reported increased activity over December, fifteen reported decreased activity and three reported operations on a par with December. Three of the most pronounced relative decreases were largely seasonal. Hence, while the lighting load probably decreased slightly during January, the industrial load in the aggregate undoubtedly exceeded that of December. The result of these two opposing tendencies in the aggregate

TABLE I—CENTRAL STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
Feb.	76	2,453,671	2,711,800	-9.4	69	$55,540	$48,633	14.3
Mar.	76	2,806,609	2,989,581	-6.1	70	55,513	49,071	13.3
April	77	2,675,949	2,895,067	-7.0	72	55,326	49,064	12.8
May	77	2,668,457	2,889,174	-7.6	72	53,901	47,932	12.6
June	77	2,686,479	2,872,900	-6.4	70	52,385	47,977	9.3
July	77	2,706,016	2,949,132	-8.2	70	50,747	49,195	3.4
Aug	77	2,839,498	3,041,927	-6.7	70	51,931	50,848	2.1
Sept.	77	2,848,212	2,937,339	-3.0	70	54,501	52,955	2.9
Oct.	76	2,997,133	3,045,696	-1.5	71	57,340	55,599	3.1
Nov.	77	3,006,349	2,969,175	1.3	71	61,059	58,381	4.6
Dec.	77	3,129,729	3,024,203	3.5	71	64,054	61,333	4.5
		1922	1921			1922	1921	
Jan.	78	3,113,619	2,905,723	7.1	71	65,780	61,646	6.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
					1921	1920	1921	1920	1921	1920
Feb.	42	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	52	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	52	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	52	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	53	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50 9
July	52	18,633	20,964	-11.1	56.8	65.9	20.6	20.2	43.0	52 6
Aug.	53	19,301	20,900	-7.6	56.2	63.8	22.3	22.2	44.5	52 3
Sept.	53	19,765	21,359	-7 5	54.1	60.3	20.8	22.1	47.3	54 7
Oct.	54	19,828	22,231	-10.8	51.6	60.8	21.3	20.9	45.6	50.8
Nov.	55	19,692	21,773	-9 0	49.9	58.9	23.1	23.3	43.4	50.5
Dec.	55	21,036	22,325	-9.4	47.8	55.9	26.9	29.3	46.1	49.2
		1922	1921		1922	1921	1922	1921	1922	1921
Jan.	55	19,982	20,557	-2.7	45.7	52.7	23.0	23.9	41.2	42 3


OUTPUT
100 Per Cent of Industry
Average daily output for previous 12 months
Average daily output by months
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily revenue for previous 12 months
Average daily revenue by months
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Output in Millions of Kw.-Hours
Average Daily Revenue and Average Daily Operating and Maintenance Expenses in Millions of Dollars
1914 1915 1916 1917 1918 1919 Jan. Apr. July Oct. Jan. Apr. July Oct. Jan.
1920 1921 1922

CENTRAL-STATION OUTPUT DECREASES WHILE GROSS REVENUE INCREASES DURING JANUARY

was a slight decrease in the output under that reported for the month of December.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives further evidence of the tendency toward financial prosperity in the electric light and power industry. During January, 1922, the operating ratio of companies having steam electric generating plants only, taken in the aggregate, was 45.7 per cent, as against 52.7 per cent in January, 1921. As the high-revenue lighting load decreases with the advancing season and the low-revenue industrial load increases with returning industrial activity, the operating ratio in the aggregate will undoubtedly rise. The average operating ratio for companies having steam electric generating plants only was 54.2 per cent during the year 1921, as against 59.3 per cent during 1920.

INDUSTRIAL ACTIVITY GREATEST SINCE OCTOBER

In most primary industries industrial activity during January was the greatest since last October, and in a number of cases production was much higher than in

TABLE II—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
December	57.0	62.8	58.8	67.5	46.2	53.1	52.8	57.0	49.3	62.3	56.5	63.1	46.0	55.1	52.6	56.2	40.8	48.5	52.8	56.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.8	57.7	58.3	67.5	46.2	52.4	52.2	57.2	45.3	55.5	55.3	62.7	41.8	45.6	51.6	55.4	47.5	47.8	51.8	56.4
Hydro Plants:																				
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
December	30.8	34.3	29.2	33.4	23.4	29.9	18.4	21.8	16.5	27.2	21.3	27.5	33.8	28.3	28.9	21.5	27.9	29.1	26.2	24.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	25.0	19.3	30.0	49.7	16.7	21.4	18.0	21.8	28.9	25.6	22.0	21.1	33.8	28.3	29.2	22.2	26.6	25.9	26.1	24.3
Combined Systems of Steam and Hydro Plants:																				
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8
December	52.4	43.8	53.8	55.8	44.3	53.4	43.4	48.1	43.6	57.6	46.9	57.0	48.0	44.3	43.8	45.8	47.0	43.1	37.9	42.8
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.7	43.1	53.4	54.6	39.9	44.7	43.0	47.8	38.8	43.9	46.2	56.1	40.1	38.6	43.8	45.2	33.5	32.2	38.0	43.1

TABLE III—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States		
		Percentage of Installed Ratings Represented	1921 Thousands	1920 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1921 Thousands	1920 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1921 Thousands	1920 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1921 Thousands	1920 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1921 Thousands	1920 Thousands	Per Cent Increase
KW.-HR. OUTPUT	Feb.	81	178,694	216,890	-17.6	80	902,030	970,539	-7.0	72	789,539	882,873	-10.6	59	131,654	132,537	-0.7	83	451,754	508,961	-11.2
	Mar.	80	205,348	230,309	-10.8	81	1,029,120	1,119,428	-8.1	72	894,500	941,893	-5.0	59	139,381	136,017	2.4	83	538,260	561,934	-4.2
	April.	80	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	71	828,457	894,028	-7.3	59	132,075	135,421	-2.5	89	555,048	586,894	-5.4
	May.	81	191,141	219,298	-12.8	78	934,973	989,408	-5.5	71	819,506	899,657	-8.9	59	136,573	138,416	-1.3	91	586,264	642,495	-8.7
	June.	80	192,007	219,476	-12.5	78	940,443	1,003,727	-6.3	71	806,270	880,934	-8.5	60	136,011	129,120	5.3	92	611,128	639,637	-4.5
	July.	80	187,622	218,995	-14.3	77	934,822	1,026,390	-8.9	71	804,009	884,572	-9.1	60	140,795	141,450	-0.6	92	639,768	678,725	-5.7
	Aug.	79	205,351	224,324	-8.5	78	992,681	1,054,124	-5.8	71	848,803	923,210	-8.1	60	147,967	154,353	-4.1	93	644,696	685,916	-6.1
	Sept.	79	221,364	223,269	-0.8	78	1,004,252	1,051,268	-4.5	71	851,671	886,370	-3.9	60	149,758	151,680	-1.2	93	621,167	624,752	-0.5
	Oct.	79	249,202	221,929	12.1	78	1,103,525	1,121,676	-1.6	71	919,514	930,236	-1.1	60	154,266	156,713	-1.5	94	570,626	615,142	-7.2
	Nov.	79	247,119	215,565	14.6	77	1,128,453	1,112,914	1.4	71	913,142	908,121	0.5	60	154,125	150,976	2.0	94	563,510	580,124	-3.1
	Dec.	79	253,206	216,717	16.8	78	1,196,724	1,150,695	4.0	71	948,670	925,449	2.5	61	153,340	150,646	1.8	93	577,789	580,696	-0.5
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.	81	252,836	203,887	24.0	81	1,188,754	1,072,841	1.5	71	941,148	864,963	8.8	60	158,001	146,134	8.1	93	572,880	617,898	-7.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
REVENUE	Feb.	81	$5,925	$5,728	3.4	73	$21,492	$18,327	17.4	58	$15,971	$14,070	13.6	58	$3,915	$3,329	17.6	83	$8,237	$7,179	14.7
	Mar.	80	5,784	5,566	3.8	72	21,822	18,934	15.3	58	15,853	14,103	12.4	59	3,747	3,246	15.5	83	8,307	7,222	15.0
	April.	80	5,665	5,554	2.0	72	21,504	18,609	15.8	58	15,506	13,822	12.2	58	3,744	3,312	13.2	89	8,817	7,767	13.6
	May.	81	5,362	5,342	0.4	72	20,795	17,613	18.0	58	14,866	13,558	9.8	59	3,516	3,179	10.7	91	9,362	8,240	13.7
	June.	80	5,285	5,397	-2.4	72	20,058	17,438	15.0	58	14,485	13,519	7.1	59	3,536	3,152	12.2	92	9,021	8,439	6.9
	July.	80	5,180	5,121	1.1	72	18,798	17,155	9.2	58	14,158	14,689	-3.6	60	3,509	3,145	11.3	92	9,101	8,733	4.3
	Aug.	79	5,297	5,483	-3.3	72	19,050	17,926	6.2	58	14,465	14,594	-0.8	60	3,612	3,536	2.2	93	9,507	9,309	2.1
	Sept.	79	5,694	5,857	-2.7	72	19,992	18,750	6.6	58	15,324	15,192	0.8	59	3,811	3,673	3.7	93	9,680	9,482	2.0
	Oct.	79	6,332	6,072	4.2	71	21,520	20,115	6.9	58	16,098	16,175	-0.4	60	3,920	3,903	0.4	94	9,470	9,334	1.4
	Nov.	79	6,806	6,238	9.1	71	23,282	21,541	8.1	58	17,123	16,954	0.9	60	4,139	4,158	-0.4	94	9,745	9,489	2.7
	Dec.	79	6,987	6,573	6.3	72	25,168	23,519	7.0	58	17,691	17,508	1.0	61	4,234	4,150	2.0	93	9,965	9,583	4.0
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.	81	7,205	6,582	9.5	75	26,078	24,019	8.5	58	17,678	16,715	5.7	60	4,385	4,200	4.4	93	10,368	10,085	2.9
OPERATING EXPENSES:			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Feb.	35	$1,069	$1,242	-13.9	52	$6,799	$5,937	14.5	28	$3,958	$3,445	14.8	41	$1,217	$1,053	15.5	55	$2,042	$1,963	3.9
	Mar.	45	1,576	1,651	-4.5	58	7,969	7,241	10.0	34	4,570	4,228	8.2	47	1,776	1,514	17.2	80	2,866	2,614	9.7
	April.	44	1,418	1,479	-4.1	56	7,590	7,168	5.9	34	4,347	4,112	5.7	48	1,567	1,403	11.6	80	2,893	2,479	16.8
	May.	48	1,548	1,577	-1.8	53	6,921	6,660	4.0	36	4,274	4,292	-0.4	49	1,563	1,486	5.2	83	2,969	2,713	9.5
	June.	45	1,737	1,862	-6.7	53	6,916	6,878	-0.5	38	4,843	5,152	-5.9	56	1,835	1,678	9.4	86	3,565	3,519	1.3
	July.	46	1,712	2,077	-17.6	50	6,772	7,111	-4.8	37	4,940	5,800	-14.8	58	1,870	2,039	-8.2	86	3,339	3,937	-15.1
	Aug.	47	1,861	2,088	-10.8	50	6,871	7,131	-3.6	37	5,028	5,793	-13.2	58	1,892	2,003	-5.5	92	3,648	3,884	-6.0
	Sept.	47	2,049	2,262	-9.4	51	6,851	7,294	-6.0	38	5,353	5,687	-5.8	59	1,949	2,184	-10.7	92	3,563	4,032	-11.6
	Oct.	47	2,141	2,095	2.1	54	7,175	7,927	-9.5	37	5,011	6,126	-18.2	59	1,990	2,192	-9.2	93	3,511	3,891	-9.7
	Nov.	49	2,040	1,964	3.8	54	7,103	7,790	-8.8	38	4,992	5,972	-16.4	59	1,931	2,262	-14.6	92	3,626	3,785	-4.2
	Dec.	50	2,075	1,901	9.1	54	7,993	8,378	-4.6	37	5,162	6,169	-16.2	59	1,966	2,161	-9.0	92	3,841	3,719	3.3
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.	51	2,060	1,781	15.6	55	7,210	7,563	-4.7	37	5,024	5,659	-11.2	59	1,926	2,144	-10.2	92	3,762	3,410	10.3

any recent month. Industries calling for increased electrical energy were the automobile industry, textiles and building materials, all of which were operating considerably above the 1913 average rate of production.

Increased activity was reported by both the textile and leather industries of New England during January, and several other industrial users of electrical energy in this section reported slightly increased operations. The decreasing lighting requirements, however, were sufficient to overcome these increased industrial requirements, resulting in an average daily output of 270,000 kw.-hr. below that which was reported for the month of December.

The gradual industrial revival from the point of extreme depression which has been reported by the Middle Atlantic States for the past few months was not so marked during January. Most of the industries in this section were operating at about or on a par with December.

In the South Atlantic States capacity operations continued in the textile industry, over 100,000 more spindles being active than in December. Other industries, such as the lumber trade and mining, curtailed operations under those of December. In the aggregate the industrial load of this section during January was probably under that of December.

The returns indicate, therefore, that during January the industrial energy requirements of the Atlantic section in the aggregate were under those of December. The seasonal decrease in lighting requirements was also probably under that of December notwithstanding the addition of new lighting customers during the month. The net result in this section was that the amount of energy sold by central generating and distributing companies per day was about 2,160,000 kw.-hr. under that of December.

AUTOMOBILE MANUFACTURING ACTIVITY SUBSTANTIALLY INCREASED

The automobile industry of the North Central States reported an increased production of about 15 per cent over December, and the iron and steel industry was operating slightly above December. Energy requirements by other industries of this section were about the same as during December. The decreasing lighting requirements, however, were more than sufficient to overcome the slight increases in industrial requirements, resulting in a decrease in the average daily output in this section of about 350,000 kw.-hr.

The South Central Section was the only one to report an increased energy output over that of December. In this section about 65 per cent of the industrial plants were operating on full time, 25 per cent on part time or with reduced forces, and 10 per cent were shut down.

While substantial gains in activity took place during January in the northern copper-mining regions of the Mountain States and slight increases were reported by the metal-mining regions of the southern part of the section, these increases in industrial energy requirements were offset by curtailed operations in other industries. Industrial activity in the Pacific States was slightly below December, being most pronounced in the iron and steel industry. The net result of these industrial demands in the Mountain-Pacific section, plus a probably decreased lighting load, was an output slightly under that for December.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Mental Inertia Must Be Overcome to Establish Metric System

To the Editors of the ELECTRICAL WORLD:

It is a commonly known physical truth that a moving body can be more easily maintained in its original path than diverted from that path into a new one. Psychology offers a perfect analogy in the working of people's minds. When thought on the subject of measures has happened to start along even one of the more difficult paths another force must be applied to turn it into any other road. Before any change can be brought about in this world the force of reason, or some unreasonable force, must be applied.

Human inertia can be more or less accurately estimated. Our ancestors reckoned with it when they adopted decimal currency, and the present generation has to reckon with a few special interests and this same inertia in securing the advantages of the general use of metric weights and measures.

The Britten-Ladd bill is conservative, does not necessitate any change whatever in the manufacture of goods, but calls for the use of the metric system in buying and selling merchandise ten years after the passage of the bill. According to those responsible for the Britten-Ladd bill, this does not affect buying and selling of articles by the measures in which they are now known. For instance, any one may buy or sell a two-inch pipe, although it is well known that this is a nominal size only and such a pipe is better denoted in millimeters.

When the manufactured articles of America are so expressed in millimeters, they will be sold with far greater readiness in all other countries, with the possible exception of Great Britain. As an example, rating pumps in liters is preferable to United States gallons even in Great Britain, because the use of the United States gallon is illegal in Great Britain and the corresponding British liquid measures, which differ by more than 20 per cent, are illegal in the United States.

The readers of the ELECTRICAL WORLD hardly need to be reminded of the modern and simple method of teaching the metric or meter-liter-gram system. The booklet "Metric Weights and Measures" can be obtained from the American Metric Association or from the bookstores. But the problem is to obtain the co-operation of national associations, firms and individuals in placing the movement in a right light before the American people.

If the readers of the ELECTRICAL WORLD will consider the Britten-Ladd bill and do even a little work for it, the human inertia will be overcome and this much-needed change to metric weights and measures will be greatly facilitated.

M. L. STALEY.

New York City.

Rear-Line Circuits as a Solution of Suburban Distribution

To the Editors of the ELECTRICAL WORLD:

The storms of sleet and snow in the East of the United States, and particularly in New England, bring to the front in a distressingly forceful manner the difficulties of distribution in suburban towns and in small cities as well. The fact is that in places too small to permit of general underground distribution and where the streets are well lined with trees there exist in the path of general distribution troubles and dangers of a very formidable character. One must frankly admit that there is no feasible method of entirely reliable supply where high-tension wires have to be carried through many miles of streets so lined with trees that the circuits must run among them if on the streets at all. Of course, in foreign practice, and particularly in England, the smaller towns are lucky if they have any electric lights at all, on account of the very general sentiment demanding underground service; but the American small city or suburban town, while in the aggregate the service is large and profitable, is so scattered that underground construction must be regarded as fairly out of the question—certainly until entirely different methods of working, at very much lower cost, become common. Circuits carried through long lines of trees are difficult to operate, unsightly, and if at all secure, necessitate an amount of cutting and slashing that augurs ill for the trees.

It appears to me that in a good many cases great relief could be obtained and very much better service if it were made practicable to run the circuits on the rear dividing lines of lots in the town layout, thus providing a very close equivalent to the alley distribution which has been successfully worked in many places. A dividing-line distribution as a rule does not fall foul of great numbers of trees. It does not thrust poles in front of the parlor windows, and it permits transformers to be placed well out of sight and in locations enabling them to feed a considerable group of adjacent houses. Of course, the objection which at once arises is that such a procedure means right-of-way over private property. This is the case, and it involves the outstanding difficulty of some perverse individual absolutely declining to grant rights, but the matter is serious enough for public action. It is certainly enormously for the interest of any town or small city to have a thoroughgoing and reliable distribution, and as the situation outlined exists in a very large number of communities it is sufficiently general to warrant remedy in the interest of the public. If supply companies had a right of eminent domain with respect to the rear lines of lots, under proper restrictions and without demanding punitive payments, the way would be clear for a great deal of simple and safe construction. With such an arrangement of circuits and a very modest amount of underground work of the simplest kind the ordinary suburban town or small city can be well handled with much greater security against interruptions to service than is now the case.

Continuous supply is a matter of general interest for which the public should be willing to sacrifice a little of its territorial exclusiveness, and here the interest of each is the interest of all, since failure of a circuit anywhere generally puts to inconvenience a large group of consumers.

LOUIS BELL,
Consulting Engineer.

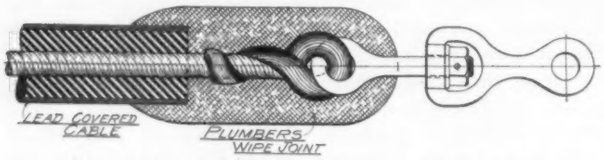
Boston, Mass.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Econor. ical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Bolt Eye and Wiped Joint Facilitate the Pulling of Cables

TO PULL lead-covered cables without damaging the lead sheath or the insulation the method illustrated here has been successfully used. This also prevents moisture from entering the cable while it is being pulled. The method is specially adapted to cables of 1.5 in. diameter over all and larger. The cable end is



DAMAGE TO LEAD SHEATH PREVENTED BY USING WIPED JOINT WHILE PULLING CABLES

prepared by removing enough of the sheath and insulation to leave a reasonable run of copper conductor to be pulled through the bolt eye shown and then wrapped back upon itself. After the copper has been well fastened through the eye bolt, a wipe joint is made by a regular cable splicer's outfit. The time required to wipe a joint of this kind is about one hour for one man, which includes the time to strip the cable and make the splice before wiping the joint. The amount of soldering material ranges from 2 lb. to 5 lb., according to the size of the cable. This, however, is melted off when the cable pulling is finished. After pulling the cable the end is sawed off as near as possible to the bolt, and the end of the cable is sealed with solder to prevent entrance of moisture.

The frictional contact of the wiped joint alone would not stand the strain of the pull, making it advisable to fasten the conductor very securely. But, on the other hand, the wiped joint must cover the lead sheath properly to prevent a tendency of the sheath to crack away from the joint, thus permitting moisture to enter the insulation. A very satisfactory distribution of the pull results when the joint is done properly.

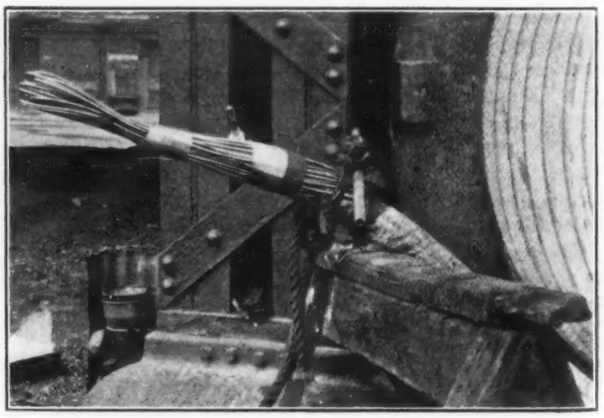
Santa Paula, Cal. A. A. BARBERA.

Submarine Cable Laid Across River by Steam Winch

PULLING cables across short stretches of water with a steam winch on one shore and the reels mounted on the opposite bank was recently accomplished with very satisfactory results by the New York Central Railroad Company. This installation consisted in running seven cables 700 ft. across the Harlem River at the Park Avenue drawbridge. Generally when submarine cable is laid it is paid out over the stern of a vessel. In this case, however, such a plan was not practicable. The breaker pier of the drawbridge lay directly between the splicing chambers on each side of the river. A cable laid from a boat would have to pass around the end of the pier and would thus be considerably longer than the width of the river. Therefore it was decided to pull the cables directly across, passing them between the piles which make up the pier. This plan also saved the work of loading the heavy reels on the boat and of unloading them. This was one of the principal reasons why it was better to pull the cable than lay it from a boat. Aside from the fact that the amount of handling of the heavy reels was reduced to a minimum, it would obviously require very much longer lengths of expensive cable if they were carried around the end of the breaker pier.

The cables were delivered on reels at the south end of the drawbridge. Each reel contained 700 ft., which was sufficient for the crossing. The first operation was to prepare the ends as shown in the accompanying illustration. This work consisted simply of unwinding three or four feet of armor wire, cutting off the piece of cable thus exposed, turning back the armor and binding it so as to form a loop for pulling it across the river. Important details in this procedure before forming back the armor were carefully to seal the end of the cable with a wiped lead cap and to place a short piece of cable or other material butting up against the sealing cap, which was held in place by the armor wire. The reason for this was to provide something which would take the squeezing of the looped armor wire while the cable was being pulled across the river and so protect the cap from any injury which might permit the entrance of moisture into the cable.

The reels were then jacked up so that iron bars



LOOP FORMED FROM ARMOR WIRE PROVIDES MEANS FOR PULLING SUBMARINE CABLE ACROSS RIVER

through their centers rested on heavy timbers. These were placed near the concrete splicing chambers where the land cables are spliced to the submarine cables. As the cables had to pass over the top of this concrete

structure in being unreeled, other heavy timbers with carefully greased beveled edges were provided to reduce abrasion to a minimum.

A steam-driven winch was set up on the north side of the river. A wire-rope cable was brought over from this side by a rowboat and passed between the piles of the breaker pier by a diver. The rope was then attached to the prepared end of the cable by a knot and clamped fast with two single bolt clamps. The actual drawing of the cable took only ten minutes, each of the seven cables being pulled over separately in this way. The cables could not be pulled together as each one had to pass between a different pair of the piles belonging to the breaker pier in midstream. Careful observation of the cable as it passed over the timbers and the gravel on the shore failed to show the slightest damage to the jute covering from abrasion in spite of the fact that it was so heavy that it wore a groove four or more inches deep in the gravel.

After all the cables were in the water a suction dredge was used to make a trench for each one. The mud is simply sucked from under each cable with the help of a diver to guide the suction pipe and see that each cable is in its trench. The action of the tidal currents covers them up. The shore ends were placed in a trench and covered at a time when the tide was at ebb.

F. A. WESTBROOK,
Field Engineer.

Habirshaw Electric Cable Company, Inc.,
New York, N. Y.

Steel Plates Protect Poles

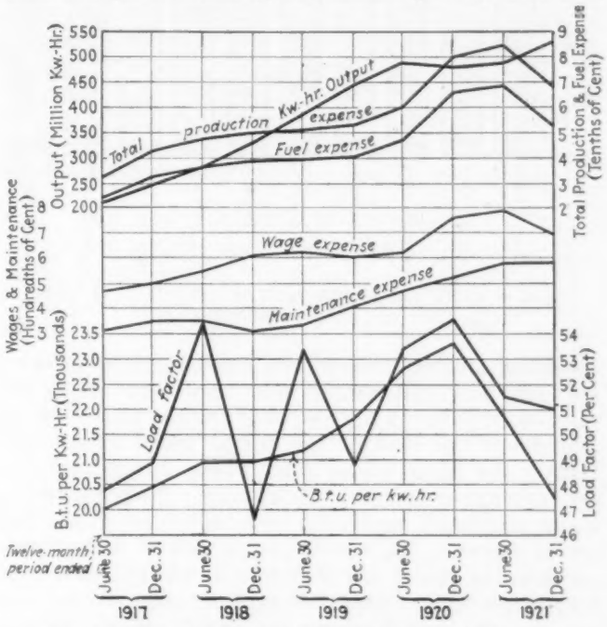
TO PROTECT the butts of a number of poles placed very close to the edge of the pavement along a Texas highway from damage by hubs of automobile and wagon wheels, steel plates ¼ in. thick and 18 in. long by 12 in. wide have been fixed to them. The plates are held to the poles by six lag screws and placed so that the lower edge is about a foot above the ground. The protection which the plates give is well demonstrated by the many deep abrasions showing on them. Without the plates the poles would have been severely cut.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Comparison of Production Expenses at Connors Creek

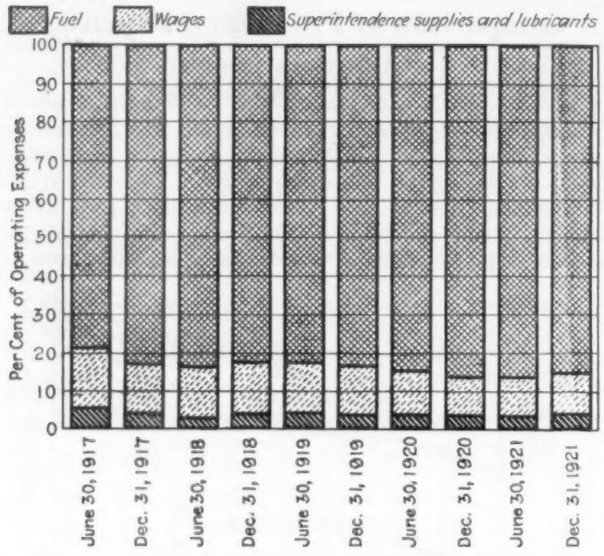
PRODUCTION expenses of the Connors Creek power station per kilowatt-hour of output are fortunately available again through the courtesy of Alex Dow, president of the Detroit Edison Company. The most striking change since we last reported any data (see ELECTRICAL WORLD for Nov. 5, 1921, page 928) is the increase in plant economy, the B.t.u.'s per kilowatt-hour being the lowest since the year ended June, 1917. This is a credit to the company's operating force, because the annual load factor is 3½ per cent lower than the maximum that has existed since June, 1917. Both the average load and maximum load have increased approximately 9 to 10 per cent in the last twelve months, the actual kilowatt-hour output having increased nearly 9 per cent in that period. Although the latest published



TENDENCIES IN PRODUCTION EXPENSES, ECONOMY AND LOAD FACTOR AT CONNORS CREEK STATION

COMPARISON OF PRODUCTION EXPENSES PER KILOWATT-HOUR OF OUTPUT FOR CONNORS CREEK POWER HOUSE OF DETROIT EDISON COMPANY

	Twelve-Month Periods Ending									
	1917		1918		1919		1920		1921	
OPERATION:	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents
Superintendence	0.010	0.010	0.009	0.009	0.010	0.010	0.010	0.012	0.015	0.014
Wages	0.047	0.050	0.055	0.061	0.062	0.060	0.062	0.076	0.079	0.069
Fuel	0.240	0.325	0.368	0.382	0.394	0.407	0.471	0.652	0.682	0.532
Water	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lubricants	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002
Station supplies and expense	0.005	0.005	0.006	0.009	0.010	0.007	0.011	0.012	0.010	0.010
Total	0.303	0.391	0.439	0.462	0.478	0.486	0.555	0.754	0.788	0.627
MAINTENANCE:										
Station buildings	0.011	0.010	0.008	0.007	0.008	0.011	0.010	0.011	0.012	0.011
Steam equipment	0.019	0.024	0.025	0.023	0.024	0.029	0.036	0.038	0.043	0.045
Electrical equipment	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.003	0.003	0.002
Total	0.031	0.035	0.035	0.031	0.033	0.041	0.047	0.052	0.058	0.058
Total production expense	0.334	0.426	0.474	0.493	0.511	0.527	0.602	0.806	0.846	0.685
Output in kw.-hr.	210,039,700	249,192,200	280,814,700	327,020,500	383,252,000	445,535,500	488,060,600	479,425,900	485,189,500	527,121,200
Maximum demand in kw. (30-minute)	50,000	58,000	59,000	80,000	82,000	104,000	104,000	100,000	107,500	118,000
Average load (kw.)	23,900	28,400	32,100	37,300	43,700	50,800	55,600	54,600	55,300	60,200
Load factor	0.478	0.489	0.544	0.466	0.533	0.488	0.534	0.546	0.515	0.510
Coal per kw.-hr. (lb.)	1.52	1.61	1.63	1.63	1.67	1.73	1.83	1.92	1.78	1.62
B.t.u. per kw.-hr.	20,040	20,470	20,930	20,900	21,200	21,800	22,800	23,300	21,800	20,250



FUEL CONSTITUTES 85 PER CENT OF OPERATING EXPENSE (NOT INCLUDING MAINTENANCE)

operating and maintenance expenses per kilowatt-hour are still more than double what they were during the year ended June, 1917, they have dropped nearly 19 per cent below the peak of the period ended June, 1921. During the latter period fuel, wages, superintendence and lubricants were at their peak. Maintenance of steam equipment reached a new high level in the last period reported, but this is due largely to undertaking maintenance, which was deferred previously because of high prices or the impossibility of carrying on the work owing to the lack of reserve equipment. While the unit cost of fuel has dropped below the values for the twelve-month period ended June, 1921, it still represents 77.7 per cent of the total production cost, wages ranking second in magnitude, being 10.08 per cent, and maintenance third, or 8.47 per cent.

The exact data comparing production expenses are given in the accompanying table. Better mental pictures of the past fluctuations and present trends are given in the two graphs, the one on page 635 showing production expenses, economy and load factor; the one above gives relations between fuel, wages and superintendence.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Control Battery in Series with Station Main Lighting System

THE fifty-six-cell lead battery for the control of switches and for emergency lighting in a recently completed San Francisco substation has been connected in series with the station main lighting system so that the battery may be charged from the 550-volt bus. The lighting for the station is provided by four rows of four lamps per row. In each row there are two 200-watt lamps and two 300-watt lamps. The lamps in each row are in multiple and the combination is in series with the battery. A no-voltage release is provided so that in case there is no voltage on the 550-volt bus an emergency installation of several 125-volt lamps is automatically connected across the battery. This information was contributed by J. E. Woodbridge, engineer for Ford, Bacon & Davis.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

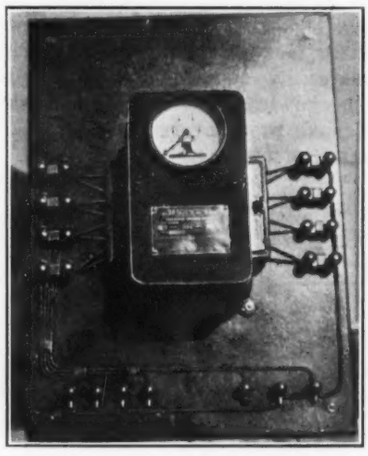
Arrangement of Meter Terminals and Links That Facilitates Testing

BY ARRANGING terminals and test links on its meter panels as shown, the Kentucky Utilities Company has been able to shorten considerably the time required for testing meters in outdoor installations and at substations. Besides making the testing easier and simpler, this arrangement also prevents the breakage of meter leads caused by their repeated removal from the meter terminals, as is necessary with the ordinary meter connections. This scheme has been employed at all places where meters must be tested frequently. It may be applied to watt-hour meters, graphic or indicating watt-meter or watt-hour demand meters.

Each meter is mounted on a slate or fiber panel large enough to accommodate the binding posts and links. These links are made out of $\frac{3}{32}$-in. spring brass and measure $1\frac{1}{2}$ in. from hole to hole. Hard-rubber insulation around the center portion protects the tester from shocks. The terminal posts or studs are made out of $\frac{1}{4}$-in. brass rod threaded the full length and are long enough to fit any board that may be used. There are eight sets of these studs for the current and potential leads. The four studs at the bottom left-hand side of the panel are used to short-circuit the current transformers in testing or in case the meter is removed to the shop for repairs. The three studs at the right are attached to the potential transformers and also serve as a convenient place to test for blown-out fuses or to attach the leads of the phantom-load primary.

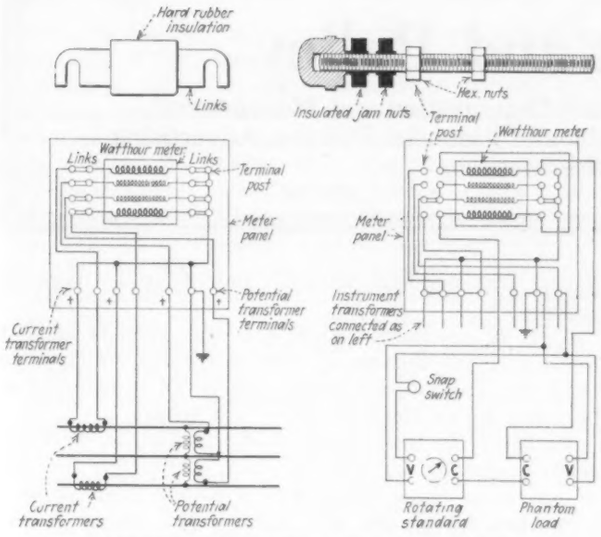
The wiring on the board is all exposed so that it can be easily traced. Colored cable is used from the instrument transformers to the test studs at the bottom of the panel to facilitate the checking of the various circuits.

Only a few changes have to be made on one of these panels to connect a rotating standard and phantom load for meter testing. The first step is to short-circuit the current transformers as shown. Then all the links except those on one of the potential coils of the meter are disconnected. The two potential coils are paralleled and fed from one potential transformer. Then the two current coils of the meter and the current coil of the rotating standard are connected in series with the secondary of the phantom-load transformer. Both the standard and phantom load are connected to the same potential transformer that supplies the meter in testing.



LINKS PREVENT BREAKING OF METER LEADS ON FREQUENT TESTS

With this method of testing none of the meter or instrument transformer wires are disturbed. Where terminals such as those described are not provided frequent testing very often breaks the leads, or in putting them back the tester may fail to tighten the terminal screws properly, thus producing a poor connection.



FACILITIES FOR QUICK, SAFE AND RELIABLE TESTING OF METERS

Left—Normal position of links when meter is in service. Right—Changed position of links when meter is being tested.

There is also the danger of reconnecting the meter improperly by attaching current leads where the potential wires should be or by changing the phase relations.

Kentucky Utilities Company, Harlan, Ky. H. S. EDWARDS, Meterman.

Diesel Engines Operate for Year at Cost of $0.0139 a Kilowatt-Hour

THE economy of Diesel engines taken alone is usually far superior to that of other kinds of prime movers, but when compared with competitive prime movers operating under adverse conditions the advantages of the Diesel engines become even more apparent. Such a case is that of the Tucson (Ariz.) Gas, Electric Light & Power Company, which has been operating four 500-hp. Diesel engines for several years. During 1921 these engines generated 6,438,326 kw.-hr. at a total average cost of $0.013995 per killowatt-hour distributed.

OPERATING COSTS OF 500-HP. DIESEL ENGINES.

These figures are averages taken from last year's operation of four 500-hp. engines based on the energy distributed. The engines were operating 76.6 per cent of the time at a station factor of 59 per cent. The average cost per gallon for fuel oil was $0.09405, for cylinder oil $0.877, and for engine oil $0.728.

Operating Factors	Gal. per 100 Kw.-hr.	Cost Per Kw.-hr., Cts.
Fuel oil	9.35	0.90149
Cylinder oil	0.0352	0.03085
Engine oil	0.076	0.0554
Miscellaneous operating expenses	.....	0.00426
Labor-operating	.....	0.1458
Maintenance	.....	0.0759
Replacements	.....	0.1858
Total		1.3995

These figures are of the greatest interest when it is remembered that Tucson is in a semi-desert region remote from fuel supply and that the station generated but 59 per cent of the possible output, although the engines were operated 76.6 per cent of the possible time.

Of the 33,792 total engine-hours possible (the fourth unit was placed in service Feb. 22, 1921) the actual engine-hours run were 25,872, and 6,331,937 kw.-hr. was distributed. Fuel oil to the amount of 606,522 gal. was consumed, costing $57,080.37, or an average of $0.09405 per gallon. This equals 10.70 kw.-hr. per gallon of fuel oil, or a cost of $0.00888 per kilowatt-hour generated and $0.00903 per kilowatt-hour distributed. In the usual practice of comparing output on a kilowatt-hour-per-barrel basis the year's run was made at an average of 449.4 kw.-hr. per barrel, which compares rather favorably with the record of 333-335 kw.-hr. per barrel achieved by two high-economy 10,000-kva. steam-turbine stations installed elsewhere in Arizona.

The cost of replacements during year was $11,770.89. Although comparatively large, this was due to the engines being of the earlier type, they having been built during the rapidly changing development stage. This was contributed by Frank E. Russell, manager of the Tucson Gas, Electric Light & Power Company.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Static Condenser Table for Correcting Power Factors of Motors

TO SHOW quickly what size of static condenser is required to raise the power factor of motor circuits the accompanying table has been prepared. When the motor input and power factor are known the table will give the necessary condenser capacity to increase the power factor to any desired value. The table applies to a unit input of 1 kw. at any power factor from 40 to 100 per cent. Exact condenser sizes are given to raise these values to 80, 90, 95 and 100 per cent. For an input over 1 kw. it is necessary to multiply the values for condenser sizes by the kilowatts input.

POWER-FACTOR CORRECTION FOR INDUCTIVE MOTORS BY USING STATIC CONDENSERS

The figures multiplied by the kilowatt input give the necessary condenser kva. for correction from one power factor to another. These figures are the difference of the tangents of the angles whose cosines are the power factors used.

Initial Power Factor Per Cent	Final Power Factor, Per Cent 100	95	90	80	Initial Power Factor Per Cent	Final Power Factor, Per Cent 100	95	90	80
40	2.291	1.962	1.806	1.541	70	1.020	0.692	0.536	0.270
41	2.225	1.897	1.741	1.475	71	0.991	0.763	0.507	0.241
42	2.160	1.832	1.676	1.410	72	0.964	0.636	0.480	0.214
43	2.099	1.771	1.615	1.349	73	0.936	0.608	0.452	0.186
44	2.041	1.713	1.537	1.291	74	0.908	0.580	0.424	0.158
45	1.984	1.656	1.500	1.234	75	0.882	0.554	0.398	0.132
46	1.930	1.602	1.440	1.180	76	0.855	0.527	0.371	0.105
47	1.878	1.550	1.394	1.128	77	0.828	0.500	0.344	0.078
48	1.827	1.499	1.343	1.077	78	0.802	0.474	0.318	0.052
49	1.779	1.451	1.295	1.029	79	0.776	0.448	0.292	0.026
50	1.732	1.404	1.248	0.982	80	0.750	0.422	0.266	.....
51	1.686	1.358	1.202	0.936	81	0.723	0.395	0.239	.....
52	1.642	1.314	1.158	0.892	82	0.698	0.370	0.214	.....
53	1.600	1.272	1.116	0.850	83	0.671	0.343	0.187	.....
54	1.558	1.230	1.074	0.808	84	0.646	0.318	0.162	.....
55	1.518	1.190	1.034	0.768	85	0.619	0.291	0.135	.....
56	1.479	1.151	0.995	0.729	86	0.593	0.265	0.109	.....
57	1.441	1.115	0.957	0.691	87	0.566	0.238	0.082	.....
58	1.404	1.076	0.920	0.654	88	0.539	0.211	0.055	.....
59	1.368	1.040	0.884	0.618	89	0.512	0.184	0.028	.....
60	1.333	1.005	0.849	0.583	90	0.484	0.156	.....	.....
61	1.298	0.970	0.814	0.548	91	0.455	0.127	.....	.....
62	1.265	0.937	0.781	0.515	92	0.426	0.098	.....	.....
63	1.232	0.904	0.748	0.482	93	0.395	0.067	.....	.....
64	1.200	0.872	0.716	0.450	94	0.362	0.034	.....	.....
65	1.169	0.841	0.685	0.419	95	0.328	.....	.....	.....
66	1.138	0.810	0.654	0.388	96	0.291	.....	.....	.....
67	1.108	0.780	0.624	0.358	97	0.250	.....	.....	.....
68	1.078	0.750	0.594	0.328	98	0.203	.....	.....	.....
69	1.048	0.720	0.564	0.298	99	0.142	.....	.....	.....

Take, for example, a 5-hp. motor operating at half load. The input, which can be taken either from a meter or figured from the efficiency table of the manufacturer, would be 2.194 kw. with a power factor of 55 per cent. It is desired to correct this motor to have a 90 per cent power factor by using static condensers connected directly to the machine circuit. Multiply 2.194 by 1.034, the figure in the table at 55 per cent initial power factor for a correction to 90 per cent. This gives 2.269 kva., the size of condenser necessary.

National Electric Condenser Co., Philadelphia, Pa. J. L. MERRILL.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

A Program for Obtaining More Power Business

Some Timely Suggestions Presented by George H. Jones of the Commonwealth Edison Company Before the Recent Joint Convention of Illinois Utilities in Chicago

A CASUAL observer might wonder how a campaign for "more business and better business" can be put on in the industrial field at a time when business in general is "marking time," to say the least. A close analysis of the situation, however, will convince one that there are great possibilities in spite of unfavorable conditions. The whole situation has changed radically during the last two years. During the war and the period shortly thereafter business was being forced upon us. In fact, the time arrived in many cases when we were forced to refuse all business that was not of the most urgent necessity to supply. Today we are facing an entirely different situation. There are, as a rule, no urgent demands for power. In the meantime the central-station companies have, as a whole, installed additional equipment both in generating capacity and distribution system, so they can take on new business and are anxious to do so. We, therefore, have not only new generating units, but the falling off of business in general has released other equipment, so that it is incumbent upon us to use our best brains and effort to get new business. As a suggested program to accomplish that result I offer the following:

G. H. JONES

1. The first thing to be done in this connection is for the power salesmen to "sell" themselves on the idea that a business-getting program can be put on at this time. This is of prime importance because if we go out in a half-hearted way we can accomplish nothing.

2. The next step is to make a survey of all power "prospects," analyzing each one, the idea being to lay stress on those classes of business that will give the most desirable load. In this connection I should like to point out that in view of the present cost of generating equipment it is more desirable than ever to obtain business that is off-peak in its nature. Attention should, of course, be paid to other classes of business, even though they are not so desirable, our slogan being "Electric service for every requirement."

3. Map out a publicity campaign using the newspapers and personal letters followed up by personal solicitation.

4. It is especially desirable at this time to keep in touch with the architects, as they are developing plans for numerous projects which will in all probability be launched within the reasonably near future.

Probably the most fertile field in which to start our work is that of the isolated plant. Although the cost of operating these plants has doubtless been reduced somewhat during the last few months, owing to the lowering cost of coal and supplies, yet in every case that has come to my notice these operating costs are still very high; so that there is no doubt that a central-station company can be of real service to owners of isolated plants.

At this time all managers of isolated plants are looking for economies and will gladly listen to what we have to say along these lines. Possibly they are reluctant to call upon us owing to the fact that for years they may have turned a cold shoulder to our proposition. As an example, I might cite a case that came to my attention some little time ago involving a large industrial plant that was operating a modern, highly efficient turbine station.

On being approached recently regarding the matter of power, the manager of this plant was found to be in a very receptive frame of mind and, in fact, stated that he had been wondering for some little time why the central-station people had not been around to see him in regard to the power situation. Doubtless there are many owners of plants who feel this same way. The experience we have had with our present customers has demonstrated beyond a doubt that we rendered them a real service when we induced them to enter into a contract with us. We can, therefore, go with confidence to these isolated-plant people and without doubt secure a very good load during the next few months.

Growth of Southern California Edison's Customer Ownership

STOCK-SELLING activities of the Southern California Edison Company, as indicated by the number of dividend checks sent out to its consumer-stockholders on Feb. 15, points to the rapid growth of home ownership of this utility. Statistics compiled by Vice-president A. N. Kemp, in charge of the company's financing, show that the company has 25,000 stockholders residing in the ten counties of southern and central California in which it supplies electric service as against 2,000 stockholders residing outside of the radius of its operations. This condition is the result of the company's aggressive campaign for new stockholders carried on in 1921, whereby the number of stockholders was increased from 7,169 to 26,889, or by 370 per cent.

The total amount paid out by the Edison company in

dividends for the first quarter of this year amounts to $621,000. The company has 20,789 consumer-stockholders in its twenty-eight districts, in addition to approximately 4,100 employee-stockholders, bringing the total stockholders residing in the territory served by the company to 24,889. Only about 2,000 stockholders in the company reside outside of the territory which it serves. The total number of dividend checks mailed on Feb. 15 to resident and outside stockholders was 26,889. On March 15 the total number of stockholders had increased to 27,831. During the past year the company financed development and extensions for more than $17,000,000 from the sale of its common stock at a price only slightly below par, at a time when the general market reached its lowest level for industrial and utility securities. The sales during 1921 were made at retail by the company through its own securities department and its employees' organization and by conservative and judicious advertising.

On Feb. 1 the company limited the amount of stock to be purchased by any subscriber to twenty shares. It fixed the amount of stock to be sold during 1922 at 75,000 shares, and, judging by the present demand, it would all be disposed of in a short time if the limitation as to the amount sold to one person had not been made. The idea of limiting the sales was to make the stock available to the greatest number of people. The effect has been to add twenty California stockholders to every one in the East.

This year the Edison company expects to spend $22,534,000 for new water-power plants and distributing lines to provide for the expected addition of 50,000 new consumers. Of the total construction expenditures, more than $10,000,000 will go for labor, in addition to the regular operating payroll of $5,500,000.

More Co-operative Window Displays at Hartford

REFERENCE has already been made in these columns to the displays of local manufactured products in the windows of the Hartford (Conn.) Electric Light Company, those products being selected from establishments using central-station energy. This co-operative

DISPLAY OF PRODUCTS MANUFACTURED BY ONE OF THE HARTFORD COMPANY'S CUSTOMERS

publicity has been continued and has attracted a great amount of interest in Hartford because of the striking displays of "home-made" products, often of a national reputation. One of the recent displays showing heating equipment and related products of a Hartford concern is pictured here.

Six-Day Electrical Show at Providence Draws 12,128 Visitors

ANOTHER example of the sales and educational value of an electrical show is seen in the recent experience at Providence, R. I. Under the auspices of the Rhode Island Electrical League, this, the first, electrical show at Providence was visited in six days by

PARTIAL VIEW OF PROVIDENCE'S FIRST ELECTRICAL SHOW

12,128 persons, and when the show closed after a week's run Manager N. I. Allen stated that the sales consummated by the exhibitors indicate that it was a complete success financially. The illustration shows a corner of the show, which was held in the ballroom of the Providence Plantations Club.

What Other Companies Are Doing

San Diego, Cal.—To improve its present system of employee identification the San Diego Consolidated Gas & Electric Company has distributed numbered and registered identification badges to meter readers, troublemen, inspectors and others calling upon the public. As customers generally hesitate to demand an employee's credentials, the employees have been requested to display their badges at all times.

New Orleans, La.—The people of New Orleans are to have an opportunity of seeing for themselves the advantages and comforts of the latest electrical appliances for the home. The Electrical League of New Orleans plans to open an electrical home, and at a recent meeting the executive committee of the organization it was ordered to make complete arrangements for the equipment of this method of electrical demonstration, which is new to New Orleans. The home will be opened to the public Sept. 1.

Minneapolis, Minn.—The commercial department of the Northern States Power Company reports another record-breaking year for 1921. In spite of the fact that most businesses and industries suffered somewhat because of the depression, the company shows a gain of 14,459 electric customers, with 27,803 kw. in lighting and 21,110 hp. in motors.

Worcester, Mass.—A twenty-seven-day campaign for house-wiring started on the Worcester Electric Light Company's system March 27, the feature of note being a credit allowance on the wiring bill equal to the total amount paid the company for the first five months' use of electricity. A first payment of $5 is required, with the balance of the payments spread over a maximum period of one year.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development, the Business and Economic Problems of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Influence of the Underwriters' Inspection on Quality

By W. E. Robertson
General Manager Robertson-Cataract Electric Company, Buffalo, N. Y.

At the time the Underwriters' Inspection Bureau was organized several years ago—and the matter of going into the bureau was a debatable one on the part of certain manufacturers — it was pointed out that those manufacturers who had sold goods on quality and had received more for the goods by reason of the recognition by the trade of the high quality of their product would throw away the benefits which they had gained by years of advertising quality and actually showing it in their product. Some of the manufacturers felt that this position was well taken, but that it was more than offset by the consideration that if all manufacturers had to maintain a certain standard of quality in order to have their product used it would tend to reduce competition. This seemed to be especially true in the manufacture of rubber compounds used for insulating purposes, whether on wire or other materials.

W. E. ROBERTSON

Soon after the Inspection Bureau was established the difference in price which the quality manufacturers formerly enjoyed disappeared, and it was also found that the standard of the Underwriters' Bureau was no deterrent in keeping other manufacturers out of the field, as no manufacturer who wanted to enter into competition with existing manufacturers seemed to have difficulty in finding the necessary technical help to produce an article which would meet the Underwriters' requirements. Instead, therefore, of helping the quality manufacturers the bureau proved to be a source of distinct loss to them.

Insurance companies, which maintain the bureau for their protection, are interested primarily, and should be solely, in establishing standards that reduce the fire hazard to a reasonable minimum. No one should attempt to use this bureau for any other purpose, because to do so will result in inevitable disappointment.

With the present method of protecting each circuit against overload by proper fuses the insulation on most wires used for interior purposes is of little or no consequence, because bare wires could be used with equal safety from a standpoint of fire hazard. When it comes to safety switches, these are for the reduction to a minimum of losses from accidents and not from fire. Of course, where wire is used in damp places the rubber insulation is valuable, but even here it is of little practical value from a fire-protection standpoint, because fuses protect the circuits; the insulation simply reduces to a minimum the blowing of fuses due to short circuits. There is very little needed today for improvement in passive things, such as cables, conduits, fuse blocks, etc., but there is a distinct need of improvement in things that are movable, such as the springs in key and pull-chain sockets, snap and push-button switches, the contact points in switches, flatirons, toasters, etc.

The standard of the Underwriters' Bureau must always be the minimum requirements from an insurance standpoint. To make these standards unnecessarily high would be to increase inexcusably the cost of installation, thereby reducing the use of electricity, and anything that unnecessarily tends to reduce the use of electricity is a disadvantage to the industry as a whole, although it may be an advantage to a particular manufacturer or group of manufacturers.

How to protect the honest manufacturer of quality goods from the claims of equal quality on the part of the outlaw manufacturer is a big problem, and one which cannot easily be solved by the Underwriters because, primarily, that is not their function. A certificate as to quality from an absolutely honest, impartial and fearless testing laboratory might be the solution.

Guarantees of service from the manufacturer or his distributers extending over a period of years are unwise as well as impracticable, because of the difficulty of arriving at the exact facts in order to make adjustments. The best solution of this intricate problem seems to be found in providing the quality and increasing the price to a point which will not only cover the cost of the improved quality but the cost of selling this knowledge to the trade and through it to the public. The manufacturer who is determined to produce quality goods as the foundation on which he wishes to base his success should set aside as a capital expenditure a substantial sum for advertising purposes, this sum to be written off over a period of years in the same way that depreciation is provided for out of earnings.

It would not take many years to sell quality goods to the trade, because most men in trade are honest and will not knowingly sell an inferior article to a customer. The time will never come when quality goods will be exclusively used, because there is always the outlaw manufacturer, the outlaw jobber and the outlaw contractor who have but one object in life and that is to make the immediate dollar on the theory that after them comes the deluge. The great majority, however, of all manufacturers, jobbers and contractors are honest men who take pride in their business and their self-respect.

Direct Sales to Dealer and Good Servicing the Key to Large Appliance Business

BY A MANUFACTURER

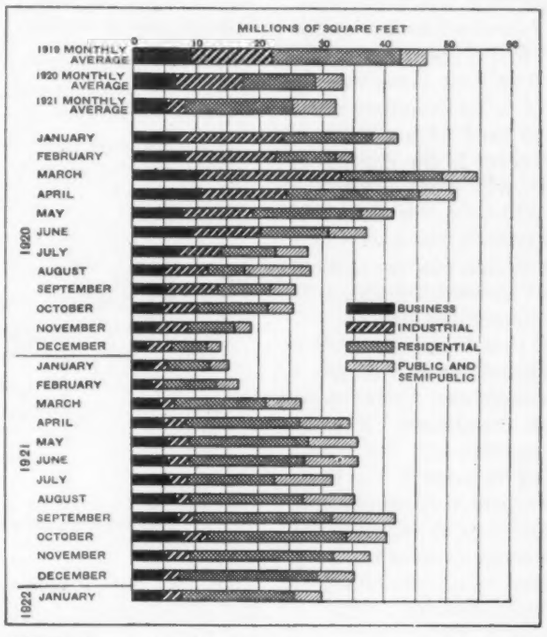
THERE is nothing more vital to the manufacturer of an appliance than his responsibility to the ultimate user of his goods. He must "make good" to the women who buy his sweeper or his flatiron or his washing machine not only in 100 per cent quality but in all the local service they are entitled to and in a responsibility to stand behind that appliance just as long as it may last in service. It should be the first consideration and the last consideration to every manufacturer and also to every retailer or wholesale distributer who sells the goods.

For that reason it has been my experience that the manufacturer of large electric labor-saving appliances should if possible obtain direct contact with the user by the maintenance of retail stores that may themselves market the goods to the household without any other handling on the way from the factory. Service is so important that every bit of profit which the appliance can pay should be retained by the manufacturer himself for appropriation in local selling and in local service. Not that electrical devices of today are costly in servicing, for the amount of service needed because of defects in the machines themselves is exceedingly small. But the sales opportunity offered by the thorough schooling of this new customer in the use of the machine is of tremendous value. Not only does it insure satisfaction with the appliance but it guarantees other sales as a product of the enthusiasm of every well-schooled user. And it upbuilds a contact and a friendship that inevitably lead to the sale of other appliances needed in the gradual complete equipment of the house.

It pays, therefore, to put every dollar possible into the servicing of the machine, and it does not seem to be possible to provide sufficient spread to share profit in distribution through the ordinary electrical trade channels and have left to do the local job. If the dealer is established so that he is purchasing in carload lots, the warehouse function of the jobber is, in my opinion, not needed. But the dealer must provide a volume that will hold down the costs of delivery, and he works close enough to the manufacturer to function as his store in all that is needed to maintain the manufacturer's responsibility to the user.

The department store cannot service electrical appliances. The jobber is not equipped or organized to do it either. But the dealer can, and if he does his full job of selling and servicing, his opportunity can be unlimited and he is entitled to all of the profit which the manufacturer can figure in. Volume of sales demands that the price be not too high. Volume of sales is essential if the cost is to be kept low. The development of the largest possible volume of sales depends inevitably on the free flow of goods from the manufacturer to the local store and prompt sales through the skillful servicing of all machines that go into the town.

Volume of Building Contracts Awarded



THE impression is strong in every man's mind that building is increasing, but here is a clear picture of just what is happening. Contracts awarded in January of this year totaled $166,320,000, against $111,608,000 in the same month in 1921, and every new house built adds to the market for electric service, equipment and appliances. This chart is a clear picture of opportunity for electrical men.

Large Electrical Appliances Not Profitable to Some Department Stores

MANY and widely varying estimates have been made of the value of the department store as a factor in the sale of electrical appliances. It was reported one New York department store was purchasing washing machines in trainload lots and that another store had sold 60,000 vacuum cleaners in twelve months. Theodore E. Burger, secretary of the Society for Electrical Development, undertook to verify these figures and his comments upon what he found are particularly interesting. He says:

> In investigating these two statements I discovered, in the first instance, that the particular store which was supposed to be doing a land office business in washing machines had never purchased but one carload of washing machines at a time, and when I visited them I learned that they were so disgruntled over the doubtful feasibility of profitably merchandising large electrical appliances that they had but recently decided to discontinue handling both washing and ironing machines.
>
> In the second case cited, I found that the department store which was accredited with having disposed of sixty thousand vacuum cleaners in twelve months had in reality actually marketed only thirty-three hundred during that period, and that a considerable portion of this number had been sold at "sales," meaning at very-much-marked-down prices. I found this same store was displaying an ironing machine on which the customary retail price had been cut one-third. Inquiry led to the discovery that even at this marked-down price they had only sold one machine in thirty days. This store was in the same condition of mind as the former one was with regard to the larger electrical appliances.

Definite information has also been secured from a number of department stores which are losing out in the departments devoted to large electrical appliances because they find an insufficient profit in the line to justify the space occupied by the goods. Pianos occupy more floor space, but the spread for the retailer is sufficiently great to justify the space. This seems to be a definite trend among a number of large department stores which have been disappointed in the relation of the floor space required and the profit on the large electrical appliances.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Transformer Oil Under Low Temperatures.—G. BRÜHLMANN.—An investigation of the effects of thickening upon the performance of oil-insulated transformers and oil circuit breakers is reported in this paper. The thickening or even the freezing of oil in self-cooled oil-insulated transformers is of no great danger, as the overheating, due to the impeded cooling action of thick oil, is of comparatively short duration. It might become dangerous in forced-oil-cooled transformers, as the thickened oil will find a great resistance in the flow through pipe lines. The heat generated by the iron losses alone will prevent a transformer from freezing. In no case should oil be used with a thickening point above 4 deg. C. Far greater is the danger of frozen oil in oil switches, as it will slow down the motion of the contact level and will be much slower in flowing between the contacts to quench the arc. This might cause a destruction of the switch and consequent ignition of the oil. An actual test showed, for example, that a switch takes 80 per cent longer time to open if operated at —8 deg C. with an oil that begins to thicken at —3 deg. Almost twice the normal amount of gates was generated under similar conditions. Six curve diagrams illustrate these different conditions. For the above reason it is essential to examine oils for transformers and switches in a testing apparatus for their characteristics under low temperatures. A simple and reliable "cold test" for oils is described, measuring the time the oil needs at different low temperatures to flow a distance of 40 mm. under a pressure of a 400-mm. water column.—*Brown-Boveri Mitteilungen,* January, 1922.

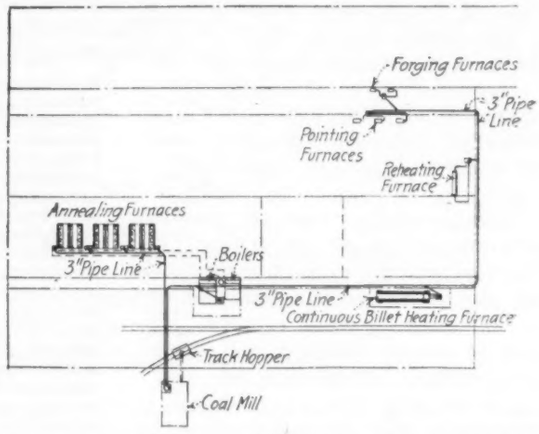
Lamps and Lighting

The Lighting of Retail Stores.—Retail stores may be divided into three classes according to quality and direction of the lighting required. These are (a) those whose unchanging floor or counter operations require a particular location of the light sources, (b) those for which general illumination with the most convenient symmetrical placing of the outlets is satisfactory, (c) those in which artistic and decorative appearance is the chief consideration. For these three classes the article discusses the amount of illumination required, type of lighting unit to use, wiring and control, color matching and color quality.—*Bulletin E-102 of the Westinghouse Lamp Works.*

Generation, Transmission and Distribution

Solving the Problem of St. Lawrence River Navigation.—CHARLES P. LOVELAND.—The author analyzes the shortcomings of the various schemes that have been proposed and questions the value to navigation of side canals. He gives his proposal for the permanent improvement of navigation between Lake St. Peter and Lake Ontario, including the major undertakings necessary.—*Canadian Engineer,* Jan. 31, 1922.

Preparing and Distributing Powdered Coal.—E. C. GREISEN.—A description of the powdered-coal installation tried out at the West Jefferson Avenue plant of the Detroit Seamless Steel Tubes Company. In this system the coal flows into a track hopper and then, by means of a pan conveyor, to a spiked-tooth crushing roll that breaks the coal up into pieces of 1¼ in. and finer. From this crusher the coal is carried by an elevator to the top of the building and then by means of a conveyor is dumped into a bunker. Bin gates allow the coal to flow



LAYOUT OF PIPE LINES AND CONNECTIONS TO DISTRIBUTING SYSTEM IN POWDERED-COAL INSTALLATION

from here onto a belt conveyor at the end of which is a coal disintegrator which reduces the 1¼-in. coal to ½ in. and finer. It then passes through an Ebro type dryer to an elevator that carries it to the final pulverizer. From here it flows by gravity into the storage bin which feeds the distributing line to the furnace. The results were so satisfactory that this system has been adopted in the plans for the new Warren Avenue plant of this company.—*Iron Age,* Feb. 2, 1922.

Traction

Mercury-Arc Rectifier for a Swiss Street Railway.—Owing to the large increase of traffic on the Bern-Muri-Worb street-car line in Switzerland, it was necessary to enlarge the capacity of the feeding substation at Worb, which contained two motor-generator sets of 100 kva. each, operating in parallel with a 330-cell, 259-amp.-hr. storage battery. The contemplated augmentation of this station would have called for an additional 200-kva. unit and at the same time an increase of the direct-current voltage from 650 to 750. It was also intended to change over from 40 cycles to 50 cycles. The new generator would have had to be wound so as readily to permit these changes. After studying the situation the railway company decided to install one large mercury-arc rectifier, rated at 225 kw., at 750 volts direct current. The efficiency of this rectifier, meas-

ured between the terminals of the 15,000-volt feeding transformer and the 750-volt direct-current busbars, amounts to 94.5 per cent at full load, including the consumption of all auxiliary apparatus, and to 93.7 per cent at one-quarter load. These are values not even reached with a rotary. The rectifier will operate in parallel with the existing motor-generators and the battery. A considerable current economy is expected.—*Brown-Boveri Mitteilungen*, December, 1921.

Installations, Systems and Appliances

Over-All Cost of Heat-Treated Parts.—C. I. IPSEN.—As the higher-priced, improved heat source has successfully withstood the competition of existing fuels, it is evident that there are other factors of greater importance in the heat treatment of steel than furnace operating costs. Most prominent among these other factors are reduced cost of subsequent operation, reduction in the number of rejections and increased life of products, with more satisfactory service. To determine to what extent these factors will overcome higher furnace operating costs an accurate cost analysis is necessary. The accompanying table shows accurate costs of several familiar heat-treated parts, together with the cost of heat treating, as well as the cost of electricity used as a heat source. Attention should be directed particularly to the last column, in which is shown the part that electricity plays in the ultimate cost. The electric power rate for all items in this table is taken at 1½ cents per kilowatt-hour.—*Iron Age*, Feb. 16, 1922.

COST FIGURES FOR HARDENING AND DRAWING STEEL SHOW THAT SUBSEQUENT OPERATION MUST BE CONSIDERED

Item	Part	Factory Cost of Parts	Cost of Heat Treating	Cost of Electricity for Heat Treating	Electricity in Per Cent of Total Cost
1	Segment combination die	$1,380	$13.50	$4.16	0.3
2	Segment combination die	1,138	12.00	3.70	0.32
3	Round blanking die	638	5.03	1.50	0.23
4	Segment blanking die	782	9.45	2.92	0.37
5	Die	795	10.53	3.43	0.43
6	Die	875	8.66	2.67	0.3
7	Gear	234	13.00	3.70	1.5
8	Gear	263	15.00	4.44	1.7
9	Gear	338	21.00	6.25	1.8
10	Gear	391	26.00	7.60	1.9
11	Gear	455	30.00	9.06	2.0
12	Die block	*110	1.75	0.65	0.6
13	Gear*	5†	.....	0.03	0.6
	Totals of all above	$7,404	$165.92	$50.11	0.68

* Hardening only, without drawing. † Estimated.

Wires, Wiring and Conduits

Extreme Sensitiveness of the Action of Reducing Atmospheres Upon Heated Copper.—T. S. FULLER.—The breaking of copper, notably in the form of wire, when subjected to constant movement or vibration is a source of much trouble and expense. The author not only explains the reason for this brittleness but indicates the cure. He points out that very slightly reducing atmospheres for long periods of time have much greater effect than highly reducing atmospheres for short periods of time.—*General Electric Review*, March, 1922.

Laying of High-Tension Submarine Cables.—L. KUNST.—This paper contains information on experiences met in installing submarine power cables in Scandinavian waters. Data are given on one 10,000-volt and one 20,000-volt three-phase cable of 1,900 m. and 1,500 m. length respectively. The arrangement of a floating 45,000-volt, 150-kva. testing apparatus used on the 20-kv. cable is of interest.—*Siemens Zeitschrift*, January, 1922.

Units, Measurements and Instruments

Calibration of Electric Meters on the Customers' Premises.—W. JANVIER.—With the aid of one or two small portable instrument transformers an auxiliary current may be superimposed, or, as the author calls it, "injected," into the meter, and by proper arrangements any desired load conditions may thus be obtained from leading to lagging current. Connection diagrams for different cases are given.—*Revue Générale de l'Electricité*, Feb. 4, 1922.

The Essentials of the Radio Compass.—LIEUT. JOHN E. WILLIAMS.—An explanation of the theory and application of the radio compass and the practicability of its use on board ship as a vital element of naval strategy.—*United States Naval Institute Proceedings*, February, 1922.

Telegraphy, Telephony and Signals

Resistance Neutralization.—EDWARD BENNETT and L. J. PETERS.—This paper enters into a detailed and quantitative treatment of resistance neutralization with special reference to its application in increasing the collective properties of radio receiving circuits. The subject is treated under three general heads. First, the general theory of resistance neutralization is developed, the conditions being stated which a device must fulfill in order to function as a resistance neutralizer toward a circuit with which it is associated. The second part shows how triode circuits may be designed to fulfill the conditions developed in the general theory and thus how these circuits may be made to function as resistance neutralizers. The third part treats of the effects of resistance neutralization upon the abstractive and selective properties of radio receiving circuits.—*Journal of the A. I. E. E.*, March, 1922.

Miscellaneous

The Past Year in English Practice.—With a few exceptions the year 1921 was the very worst within memory, industrially speaking. This was caused very largely by the coal strike that lasted for thirteen weeks. Very few extensions were made in power plant practice. The water-power resources commission published its final report during the year, and as a result considerable developments in the use of water power may be expected. The financial devastation caused by the war had a disastrous effect on the fortunes of the smaller electricity supply undertakings, especially those in private hands. Nothing was done about the electric traction problems, several extensions that were planned being held up on account of the financial conditions. There was a decided growth in the Institution of Electrical Engineers, and this is now the largest and most progressive of the great technical bodies in England.—*Electrician (London)*, Jan. 6, 1922.

Development of Electrical Supply Undertakings in Germany.—The extreme difficulty experienced ever since the conclusion of the armistice in obtaining supplies of fuel, chiefly black coal, has brought about a displacement of economic factors in Germany the effects of which are more especially felt in Bavaria. This has caused a development of all possible water powers, among which is the Walchen Lake scheme, a development of 120,000 kw. Another installation will develop 90,000 kw. on the River Isar between Munich and Moosburg. A project is also under way on the River Inn between Jettenback and Taglid, which will have a capacity of 25,000 kw.—*Beama*, January, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Revival of German Patent Convention Raises Protest

ACTION by the Senate authorizing the President to revive the patent convention entered into with Germany in 1909 has raised a storm of protest. As a result it seems probable that, pending an investigation, the President will withhold the notice reviving that treaty.

The 1909 patent convention with Germany provides that in case the United States should amend its patent laws by the insertion of a working clause this legislation would not apply to patents of German origin. The agreement is reciprocal.

Chief sentiment for the revival of the treaty of 1909 is said in Washington to exist in the electrical industry, while it is being fought by the domestic chemical industry. The situation is made the more serious by the determination of Senator Ladd of North Dakota to push his bill requiring that patents be worked within certain periods or be forfeited. Senator Ladd is convinced that there is a growing sentiment in this country for the addition of a working clause to the patent code.

Chicago Convention of A. I. E. E. to Discuss Broad Subjects

IN CONTRAST with the program of the midwinter convention of the American Institute of Electrical Engineers, held in New York last February, which was made up largely of specialists' papers, the spring meeting called in Chicago for April 19, 20 and 21 will be more than half composed of symposiums on broader subjects. The tentative program for this convention is as follows:

WEDNESDAY, APRIL 19

Afternoon. — "The Electric Hammer," by P. Trombetta; "A Relay Recorder for Remote Control by Radio," by F. W. Dunmore; "Magnetic Flux Distribution in Transformers," by K. B. McEachron.

THURSDAY, APRIL 20

Morning.—"Air-Break Magnetic Blowouts for Contactors and Circuit Breakers, Both Alternating-Current and Direct-Current," by J. F. Tritle; "The Effect of High Current on Disconnecting Switches with Special Reference to the Mechanical Stresses Resulting," by H. C. Lewis and C. T. Sinclair.

Evening.—Symposium on the transmission of energy from coal mines to large centers of distribution.

FRIDAY, APRIL 21

Morning. — "Selection of Electrical Apparatus for Cranes," by R. H. McLain; "Selection of Electrical Apparatus for Cranes," by H. W. Eastwood; "Control Equipment for Cranes," by J. F. Schnabel; "Application of Electric Power to Passenger and Freight Elevators," by H. P. Reed.

Evening. — Symposium on the proposed St. Lawrence seaway.

Some of the phases to be discussed by prominent engineers in the Thursday evening symposium are the transmission of energy in the shape of coal hauled in cars, of powdered coal in pipes, and of electricity. On Friday evening the navigation possibilities of the St. Lawrence project, its power possibilities, engineering plans and the viewpoints of the government, of the New York Barge Canal authorities, of financial interests and of power users concerning it will be discussed. Promises to take part have already been received from Julius Barnes, H. I. Harriman and Hugh L. Cooper.

Wednesday evening will be spent in social enjoyment, and Thursday and Friday afternoons in visits to local places of interest.

New York State Water-Power Act Amended

AMENDMENTS to the New York State water-power act of last year, signed this week by Governor Miller, increase the power of the state in the regulation of rates and service of licensees. Those companies which previously held legislative grants to develop water power and have not developed those projects are brought under the provisions of the water-power act. The state also has tried to safeguard its right of recapture by requiring a deduction of earnings in excess of 8 per cent.

The Governor at the time of signing the bill said that the wise policy is to encourage development by private enterprise in such fashion as to insure the maximum development and the maximum general benefit. Should the amendments prevent capital from investing in the enterprises, the Governor said that it will be necessary to consider the alternative of state development.

Supreme Court Asked to Pass On Valuation Questions

THE Georgia Railway & Power Company, the Atlanta Gas Light Company and the Railroad Commission of Georgia have, owing to confusion in the federal court, jointly appealed to the Supreme Court of the United States to pass on the four following questions:

(a) Whether the State Railroad Commission in fixing the present value of property has the right to disregard the advance in value since 1914.

(b) Whether it is the duty of the State Railroad Commission in fixing the value of the property of public service corporations to consider the value of the special franchises thereof.

(c) Whether the normal federal income tax should be

included as part of the operating expenses of public service corporations.

(d) Whether the original cost of financing should be considered by public service commissions in fixing the value of the property of public service corporations.

It is pointed out by the counsel for the appellants as well as the attorney for the appellee in the suit where these issues are involved that they are of great public interest, since they arise in a very large percentage of the cases before public service commissions, and that their final determination is of pressing importance not only to the public service corporations but to the various states as well.

Electric Utilities' Coal Reserve Increased

ELECTRIC utilities as a class have larger reserves of bituminous coal, according to the Geological Survey, than at any other time of record. Reports to the survey from 808 representative plants show a stock sufficient on March 1 for fifty-four days. This is better than the condition on Jan. 1 by a three days' supply. Since March 1 stocks have been still further increased, but no detail figures as to industries are available. The Geological Survey estimates the total bituminous coal reserve on April 1 to exceed that of March 1 by at least 20 per cent.

Broadcasting Over Electric Service Circuits Demonstrated

ELECTRIC light companies will now be able to furnish broadcasting service to their patrons through their lamp sockets, according to Gen. George O. Squier, chief signal officer of the army, who demonstrated the feasibility of this operation in Washington last week. Practically any radio receiving set, it is claimed, can be used without antennas or wave filters by merely plugging into a service outlet. Furthermore, it is contended that the electric service circuits will have no distorting effect on the speech or music transmitted because the broadcasting will not have to extend over a radius of more than five to ten miles on most systems.

The text of the statement given out at the Signal Corps reads as follows:

A demonstration was given in the office of the chief signal officer of the army of a new development in radio which is believed by experts to promise a great utility to everybody who owns an electric lamp. The congestion which has recently come about in the ether by the increase in the number of broadcasting stations promises to be relieved by this new use of "line radio" or "wired wirless."

The demonstration consisted of receiving news, music, lectures and speech from the electric lamp on the desk of the chief signal officer, it having been broadcasted upon the lighting mains. No headpieces were required, and the standard receiving set with loud-speaking horn as furnished by the Westinghouse Electric & Manufacturing Company was utilized to illustrate the method.

The whole operation of installing the device for receiving purposes merely consists of removing a lamp from any socket and inserting the receiving plug instead, exactly in the same manner as an electric flatiron or carpet sweeper is connected.

This invention brings to every home, and in fact to every room in every home where there is an electric lamp, this broadcasting service. The great feature about it is that it permits local broadcasting service without paying the penalty of broadcasting in space from the usual antenna, which has resulted already in so much confusion.

The office of the chief signal officer is not ready to announce the details by which this service is made possible. A report is expected soon showing how the high-frequency currents will be carried past transformers and other apparatus having high impedance, the methods of avoiding distortion of speech, and the effects of circuit transients on broadcasting service.

Superpower Plants Justify Themselves in Coal Emergency

EVIDENCE as to how a superpower system can meet an emergency and prove to be of great economic value is given in a statement this week by George Otis Smith, director of the United States Geological Survey, one of the functions of which is to gather coal-production statistics for the country. The Geological Survey was also the body that conducted the Boston-Washington Superpower Survey. As the coal strike starts Director Smith points out that the large plants not only use less coal per unit of energy but are also plentifully supplied to withstand a long strike. By storing coal in such large quantities these superpower stations also help to stabilize the coal industry.

"The coal miners' strike," said Mr. Smith, "brings home to the public a clearer realization of what makes the wheels go round. Our dependence upon motive power, and consequently upon coal as the chief source of that power, has given us problems that were unknown to our fathers. Today much of our national welfare depends upon how much coal is in the possession of the consumers and how long it will last them.

"In generating power the big steam plant uses far less coal than the small plant to get the same results—the government's superpower report showed that conclusively—and now the coal-stock returns made to the United States Geological Survey show no less emphatically that the larger power companies have been the most careful in their preparation for the immediate future. Even though most of the coal mines of the country should remain closed down for three months, the citizens of the larger cities need fear no interruption in their light and power service. Analysis of the reports of coal stocks in the five leading Eastern states on March 1 shows that while the state averages for all public utilities ranged from forty-eight to seventy-one days' supply, the fifteen or twenty larger power companies each had enough coal in storage to last them from ninety to 160 days, and the condition of their coal piles today is known to be even better.

"This strong position of the electric utilities not only shows that they are living up to their 'public service' responsibilities but gives point to the claims of the superpower project. The generation of electricity at superpower stations of large capacity will mean using relatively much less coal and storing relatively much more coal than small individual plants. An incidental but no less far-reaching advantage of this proposed large unit electrification of the Boston-Washington Superpower Zone would be the helpful influence of the large storage upon the coal industry itself, tending to shorten the periods of idleness, for it is this seasonal idleness of the mine workers which now adds so much to the cost of coal. So there is large economic significance in the fact that the largest power plants have made the best preparation for the threatened coal shortage."

Bill to Create Public Utilities Commission Defeated in Mississippi

A BILL to establish a public utilities commission in Mississippi to take the place of the Mississippi Railroad Commission was defeated recently in the Legislature of that state. It was proposed to give to the new body, had it been set up, jurisdiction over light, power and street-railway companies, which is not possessed by the existing body. The committee that framed the bill also reported impeachment charges against George R. Edwards, chairman of the Railroad Commission, one of the accusations against him being based upon his attitude toward the Cumberland Telephone & Telegraph Company, to which a 20 per cent increase of rates was recently granted. Mr. Edwards resigned while the proceeding was pending.

Addition to Youngstown Plant Going Ahead Rapidly

THE Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, is rapidly pushing to completion an addition to its Lowellville power generating station to house an additional 18,750-kva. turbo-generator and auxiliary equipment. With the completion of this addition the station will have a generating capacity of 75,000 kva. Additional transforming capacity will also be added, consisting of two 15,000-kva., 2,200-66,000-volt transformer banks with the necessary control equipment.

Pennsylvania Utilities Get Good Start on Business Development Campaign

A MEETING of the Eastern Geographic Section of the National Electric Light Association was held at the Adelphia Hotel in Philadelphia March 23. The meeting was intended as a local starter for the national business-development campaign and was attended by more than 200 representatives of the public utility companies of Pennsylvania.

The first speaker at the morning session was M. C. Huse, assistant to the general commercial manager of the Philadelphia Electric Company, who emphasized the value of selling household appliances as the principal factor in the stimulation of business. The advantages of central plants over private plants were also discussed by the speaker.

Statistics brought up during the discussion showed that in one case there had been an increase of 44 per cent in the use of power through the sale of electrical appliances. The creation of new appliances, chiefly the new application of existing ideas, was advocated as a practical plan in the business campaign. The increase of appliances among industries was strongly favored, as the consensus of opinion showed that the industries do not need an abnormally low rate, but are more willing to spend money for their power than are the householders.

W. C. Wagner, assistant to the chief engineer of the Philadelphia Electric Company and formerly of the Bureau of Standards in Washington, D. C., was the second speaker. His topic was "The National Electrical Safety Code." He outlined the fundamental principles of the code and gave a brief review of its history.

A luncheon was held at noon and was addressed by Joseph B. McCall, president of the Philadelphia Electric Company, who dwelt on the optimistic outlook for the promotion of electrical projects and business expansion as the result of the easier financial situation.

G. B. Regar, illumination engineer of the Philadelphia Electric Company, was the principal speaker at the afternoon session, his topic being "Better Business Through Better Lighting."

Extensive Power Development Program for Northern Illinois

PLANS are being perfected by the Public Service Company of Northern Illinois, Chicago, for extensive power development, with an initial expenditure approximating $5,000,000 and an ultimate investment of more than $20,000,000, the company adding, under the latter cost, about 200,000 kw. in generating capacity. A new station will be constructed at Waukegan, Ill., with a capacity of 20,000 kw., to cost close to $3,000,000. The present transmission system will be increased from 20,000 volts to 33,000 volts. A new 20,000-volt power line will be constructed from Evanston to Desplaines, and a distribution line will be constructed as a loop, to include Evanston, Highland Park and Lake Bluff. A new 12,000-volt line will be built between Maywood, Oak Park, Elmhurst and La Grange, which, with substation equipment, will cost about $125,000.

The work will include an addition to the present generating plant at Blue Island, Ill., to cost in excess of $150,000, while a number of substations will be built at different points. These latter include a second substation in the Chicago Heights section, to cost $150,000; a transformer plant at Highland Park, costing $30,000; a 5,000-kw. substation at Cicero, to cost upward of $140,000; an addition to the transformer plant at Evanston to provide 5,000 kw. and cost $50,000; an addition to the transformer station at Maywood, with line extensions from this place to Oak Park and Blue Island, and the erection of a new substation at Barrington, replacing a plant recently destroyed, estimated to cost $75,000.

General Gas & Electric to Reclassify Stock on Non-Par Basis

TO PROVIDE for the resumption of dividends on its preferred stock and the gradual elimination of its bonded indebtedness and at the same time create a permanent financial structure the General Gas & Electric Company has submitted to its stockholders a plan for the reclassification of its securities. The plan as contemplated calls for the formation of a new corporation to be known as the General Gas & Electric Corporation, which will take over the assets of the present company.

A new collateral trust bond issue, authorized without limit as to amount and issuable in series differing as to maturity, interest rate and tax provisions, is provided for, partly to exchange $5,646,200 bonds now outstanding and to pay part of the cost of securities purchased by the new company to the extent of 75 per cent of the cost. The $816,125 7 per cent income bonds now outstanding are to be exchanged for non-par cumulative stock of the new company, at the rate of ten shares of the new stock for each $1,000 bond.

There will be 200,000 shares of non-par cumulative

stock, with preference in event of liquidation, at the rate of $100 a share, divided into Classes A and B, the former entitled in priority to an annual dividend of $8 per share. Class B shall be entitled in preference and priority to any junior stock and to dividends at the rate of $7 per annum. The non-par convertible preferred issue will be limited to 100,000 shares and to 6 per cent non-cumulative dividends, and will have a liquidating value of $100 a share, after the cumulative preferred. The common stock of no par value will be limited to 100,000 shares, 45,154 shares of which will be exchanged on a share for share basis with the present outstanding $4,515,400 common.

In a letter to the stockholders explaining the proposed plan, W. S. Barstow, president of the company, says:

At the present rate of earnings the receipts of your company are sufficient to leave a balance for the stockholders. In considering the disposition of this balance, the directors have sought in the plan proposed to protect the interest of the stockholders in every way possible. To pay out the entire balance of earnings as dividends on stock, with no provision made for the paying off of the bonded debt, when due, would imperil the principal of the stockholders. It was decided, therefore, that any plan looking to the future success of the company must provide for the gradual and permanent retirement of the bonded debt, while dividends were being paid.

This provides a definite plan for the extension of the company's bonded debt and its gradual payment increases the actual value of the stock. If no such plan is in operation and the necessity of refunding should occur at a time and under conditions such as during the late war period, the principal of the stockholder might be entirely lost. With such a plan no refunding will be required, and every time a bond, which is the evidence of debt, is acquired and canceled, the actual value of the stocks is increased thereby.

The plan also provides for the payment of one-half of the accumulated dividends over an extended period. This is accomplished by raising the dividend rate from $7 per annum to $8 per annum per share, on stock offered in exchange for one-half of the present cumulative preferred stock.

The creation of non-par stock, which has been made possible by new state laws, will enable the company to extend its operations, and thereby increase its earnings. This change will not affect the liquidation value of the stocks as now issued, nor will it have any effect on their actual value.

Connection of City Plants of Seattle and Tacoma Proposed

RECOMMENDATION to connect the municipal electric light and power plants of Seattle and Tacoma, Wash., so that energy produced in either city can be made available in the other has been made by J. D. Ross, superintendent of lighting for Seattle, to the City Council of that place. This project, it is held, would provide an outlet for surplus power from Seattle's hydro-electric plant at Skagit River for two years after it is completed.

Mr. Ross asserts that by this means Seattle would be enabled to purchase from Tacoma considerable hydro-generated electricity during the summer months for about half what it costs to manufacture energy at the city's steam plant and could sell energy to Tacoma in the winter, when there is a surplus at Cedar River. Tacoma, on the other hand, could sell to Seattle its surplus energy at night and on Sundays during the winter, and during the summer could sell to Seattle surplus water power either day or night after Cedar River gets low.

Wisconsin Utility Associations Unite

RATIFICATION of the proposed amalgamation of the Wisconsin Gas Association and the Wisconsin Electrical Association, thus including both the light and power and the railway interests of the state in one association under the name of the Wisconsin Utilities Association, was the important event of the joint convention of the two associations at Milwaukee on Wednesday to Friday of last week. The headquarters of the new association will be at Madison, where the office will be in charge of John S. Cadby as executive secretary.

Inductive interference and overhead-line construction and maintenance problems formed the subject of the central-station group meeting on Wednesday. C. A. Wheeler of the Wisconsin Bell Telephone Company was called on to present the viewpoint of the telephone companies and responded by reading the report of the joint general committee of the National Electric Light Association and the American Telephone & Telegraph Company. Mr. Brainard of the Allis-Chalmers Manufacturing Company was present with a telephone interference-factor meter and described the instrument and its use. Professor Douglas of Marquette University called attention to the need of better design of rotating machinery looking toward the elimination of characteristics in such electrical equipment that might produce harmful harmonics.

TRANSFORMER TESTING

Closer checking of distribution transformer loads was urged, though R. L. Dodd of Milwaukee pointed out that there was no panacea for transformer testing problems in distribution work as none of the instruments used can be relied on alone to care for all conditions. The use of a thermometer, similar to a clinical thermometer, drew considerable attention as a means of checking transformer temperatures because, in using it as a maximum-temperature indicator, it was free from the disadvantage of having to be used in a vertical position. Tied to the end of a piece of cord to prevent losing it in the oil, this type of thermometer can be worked down into the coils and better temperature readings obtained. Another method that attracted considerable attention was one based on a periodical check of transformer loads from maps of the district served by each transformer. Services are counted from the records, and for residences allowances that range around 175 watts per residence consumer for lighting and ordinary load and from 400 watts to 500 watts for appliances are made.

J. E. Davidson, vice-president of the National Electric Light Association, called attention to the constantly improving financial position of the central-station companies, as evidenced by the study of forty-five utility issues of securities that as of July 1, 1920, averaged 7.7 per cent and on March 1, 1922, averaged 6.3 per cent. Attention was called to the move for legalizing utility securities as savings-bank investments and to the need of the central-station companies putting more effort into development of the appliance business as a means of increasing the residence consumption.

The officers elected for the coming year are: President, J. P. Pulliam, Milwaukee; vice-president, Ewald Haase, Milwaukee; treasurer, G. C. Neff, Madison. C. A. Phenacie, Green Bay, and G. A. Mills, Eau Claire, were elected chairman and assistant chairman respectively of the electric division of the association.

Practical Program for Tri-State Water and Light Convention

A VERY practical program has been laid out for the twelfth annual convention of the Tri-State Water & Light Association of the Carolinas and Georgia, to be held at Spartanburg, S. C., April 19, 20 and 21. Among the papers of interest to the electrical group are "Accounting for Public Utilities," by C. L. Vann, certified public accountant, Charleston, S. C.; "Mechanical Aids in Public Utility Accounting," by G. T. Moore, manager Burroughs Adding Machine Company, Charleston, S. C.; "Accounting Forms for Public Utilities," by R. E. Plimpton, manager Library Bureau, Richmond, Va.; "Distribution of Electricity from Central Stations," by H. F. Lee, manager Carolina Power & Light Company, Goldsboro, N. C., and "The Installation of Underground Structures Previous to the Laying of Permanent Roadway Improvements — Upon Whom Should the Burden Be Placed?" by W. S. Tomlinson, city engineer, Columbia, S. C.

During the afternoon of the second day there will be discussions on the following topics: Collection of bills from delinquent customers, collection of bills in case of transfer of property or removal without notice, municipal payment for service, periodic inspection schedules, technical men for boiler-room supervision, kilovolt-ampere or kilowatt basis for power contracts, insulator troubles due to dust or other influences incidental to the industry supplied, joint occupation of poles, and length of time between meter tests and repairs.

Wakefield May Sell Municipal Plant

WAKEFIELD, Mass., will consider selling its town lighting property at an early meeting of citizens, as a result of an offer approximating $300,000 from the Malden & Melrose Gas Light Company and the Malden Electric Company for the physical property and franchise provisions. If the voters decide to give up municipal lighting, plans will be made to supply the town with the best type of modern central-station service, including vigorous commercial development of the community from the electrical standpoint. The town has been purchasing energy for some years, as outlined in the ELECTRICAL WORLD for March 11, page 497, but, owing to depreciation of plant, an expenditure of $4 per capita is now necessary in view of the new business in sight.

Armstrong Radio Feed-Back Circuit Patent Upheld

A DECISION of considerable importance to the wireless art is the recent opinion of the United States Circuit Court of Appeals affirming the decision of the district court in the Armstrong feed-back circuit case. Patent No. 1,113,149 was granted to Edwin H. Armstrong Oct. 6, 1914, on an application filed on the Oct. 13 preceding. The suit was instituted by Mr. Armstrong and the Westinghouse Electric & Manufacturing Company, which controls the Armstrong patent, against the De Forest Radio Telephone & Telegraph Company.

"The invention," says the opinion, which was written by Judge Manton, "though simple in its instrumentalities, is a radical modification of an instrument which was little understood. The action of the audion was very obscure and was not understood in the art, until Armstrong wrote his article in the ELECTRICAL WORLD on Dec. 12, 1914, and later an article in the Radio Institute paper in September, 1915. These articles demonstrated the action of the simple audio detector and of the feed-back audion as a detector, amplifier and oscillator."

Evidence was offered by the defendant company attempting to show that De Forest had conceived the idea of feed-back regeneration in 1912 and 1913. The court, however, after reviewing such testimony as was offered, was of the opinion that De Forest did not have prior knowledge of the feed-back circuit, either how to set it up or how to control it.

New Orleans Commission Council Held to Be Rate-Making Body

IN DECIDING that the Commission Council of New Orleans is a rate-making body, the Louisiana Supreme Court, in an opinion just handed down, sets at rest the contention of the Attorney-General of the state that the state alone is the rate-making body and that the negotiations between the city of New Orleans and the security holders of the New Orleans Railway & Light Company come within the purview of the Public Service Commission recently created by the constitutional convention. The opinion of the court was unanimous, all nine of the judges of the tribunal of last resort concurring in the decision. Under this ruling it is hardly possible that Attorney-General Coco will seek to delay further the conference between the city and the security holders of the railway and light company, which were terminated abruptly by the state last fall through injunction proceedings.

Federal Power Commission Issues Licenses and Permits

CONSIDERABLE business was transacted at the meeting on Monday of the Federal Power Commission. The issuance of a license to the Wyoming Power Company covering a power development at Boysen dam on the Big Horn River was authorized, and a conflicting application which had been filed by John T. Clarke was denied.

The issuance of a license to the San Joaquin Light & Power Corporation of Fresno, Cal., to cover the natural flow in the north and west forks of Kings River was approved.

An extension of six months in the time of the preliminary permit of the Hydraulic Race Company of Lockport, N. Y., was authorized. Article 5 of the water-power act requires that the applicant furnish evidence of state authority to transfer water. This the Hydraulic Race Company has been unable to do in the matter of transporting water through the barge canal and of its release into its canals in Lockport. Its inability to do so has been occasioned, according to data laid before the commission, by divided jurisdiction between the Superintendent of Public Works of New York and the New York State Water Power Commission in regard to the surplus water in the canal. The situation, however, has been modified by the recent passage of legislation by the New York Assembly.

The commission has rejected the application of L. J. Vogter of Tacoma, Wash., for a preliminary permit to

develop power at Swan Lake and Fish Creek in Alaska. The application was in conflict with the proposed project of Paul Butler of the Butler Paper Corporation.

The application by Waln & Young for a preliminary permit covering a project on Power Creek near Cordova, Alaska, was also rejected, a permit being issued to the Alaska Public Utilities Company.

The commission found that the interests of interstate commerce were not affected by the proposal of the Caddo River Power & Irrigation Company of Little Rock, Ark., to construct two dams and power houses on Caddo Creek, in Arkansas, or by the proposal of the Iowa Railway & Light Company of Cedar Rapids, Iowa, to construct a dam in Cedar River near Rochester, Iowa, or by the proposal of the Chipola Light & Power Company of Marianna, Fla., to construct a dam in the Chipola River near Marianna.

The Holston River in Tennessee was held to be navigable and to have important power possibilities, and for that reason an adverse report was rendered on a declaration of intention by C. N. Smith of Rogersville, Tenn., who proposed to construct a dam in the Holston River at Kirkpatrick Shoals, 2 miles south of Rogersville.

The following preliminary permits were authorized:

Wrangell (Alaska) Pulp & Paper Company, covering the development of a 12,000-hp. project on Grant and Hardings Creeks.

The Dixie Power Company, covering a dam from 200 ft. to 300 ft. high at the mouth of the north fork of White River.

J. H. Hughes of San Francisco, to develop 4,000 hp. on French Creek for an electrochemical plant.

Benjamin H. Hardaway of Columbus, Ga., to develop 5,000 hp. in the Choctawhatchee River at a point near Geneva, Ala. Another permit covers a proposed project on Pea River in the same vicinity.

The city of Oskaloosa, Iowa, to develop power on the Des Moines River in the vicinity of Harvey, Iowa.

The Caddo River Power & Irrigation Company, Little Rock, Ark., to erect three dams and develop 50,000 hp. on the Ouachita River in the vicinity of Hot Springs. The upper dam will create a reservoir covering 72 square miles.

The Big Horn Canyon Irrigation & Power Company, Hardin, Mont., to construct a dam 480 ft. high for a combined power and irrigation project at the mouth of Big Horn Canyon.

Jail Sentence and Fine for Theft of Energy in Ohio

ONE year in the state penitentiary and a fine of $500 was the sentence imposed in the criminal court in Youngstown, Ohio, upon a man who was convicted on complaint of the Pennsylvania-Ohio Power & Light Company of stealing electrical energy. A motion for a new trial was denied by the court, but an appeal was taken by the defendant which acted as a stay of execution. The maximum penalty prescribed for this offense by the Ohio law is three years in the penitentiary and a fine of $1,000.

Eleven persons have been prosecuted by the Pennsylvania-Ohio Power & Light Company within the last few months for stealing energy. Ten of the defendants pleaded guilty and received sentences ranging from a fine of $50 to $200 and in some instances jail sentences in addition for ten, fifteen and thirty days.

March Yield on New Financing Down to 6.62 per Cent

STOCKS and bonds amounting to $55,160,000 were offered investors by the electric light and power public utilities during the month of March. This figure is the highest total reached this year and represents an increase of more than $30,000,000 over March, 1921. An interesting feature of the month's flotation was the exceptionally long-term issue offered by the Southwestern Power Company, amounting to $3,000,000 and maturing in 2022. The rate of return yielded the investor dropped to 6.62 as compared with 6.90 for the month of February. Long-term securities continue to predominate. The fourteen-million-dollar issue of the North American Edison Company constitutes the largest single offering.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Kansas Gas & Electric Co.	$8,000,000	Thirty-year	First mortgage sinking fund gold bonds, series A	To refund bonds falling due and to reimburse company for expenditures	6	6.25	96½
Pennsylvania Edison Co.	1,350,000	.....	Cumulative preferred stock	.....	8	8	100
Standard Gas & Electric Co.	3,000,000	Fifteen-year	Convertible secured gold bonds	To retire bonds falling due	7	7.50	95
	250,000	Thirteen-year	Gold notes (closed issue) of 1915	.....	6	7.70	86
New York State Gas & Elect. Corp.	700,000	Thirty-year	First mortgage gold bonds	.....	6	6.40	94½
Luzerne County Gas & Elect. Co.	1,000,000	Twenty-five-year	General and refunding mortgage gold bonds, series A	.....	7	7.20	98
Hagerstown & Frederick Railway Co.	200,000	.....	Cumulative preferred stock	.....	7	7	Par (50)
Public Service Corp. of New Jersey	3,700,000	.....	Cumulative preferred stock	.....	8	8	100
American Public Service Co.	1,000,000	Twenty-year	First lien gold bonds	.....	6	7	89
Western States Gas & Electric Co.	5,000,000	Twenty-five-year	First and unified mortgage gold bonds, series A	To provide funds for extensions	6	6.50	94
Iowa Railway & Light Co.	300,000	Twenty-year	First and refunding mortgage gold bonds of 1912	.....	5	6.18	91
Northern Ohio Traction & Light Co.	7,500,000	Twenty-five-year	General and refunding mortgage gold bonds, series A	To reimburse company for construction expenditures and for debt retirement	6	6.30	96
Central Illinois Power Co.	1,500,000	Twenty-year	First mortgage sinking fund gold bonds (closed issue)	To make additions and extensions	7	7.10	99
Central Maine Power Co.	810,000	Twenty-year	First and general mortgage gold bonds, series B	.....	6	6.12	98½
New Jersey Power & Light Co.	100,000	Twenty-year	First mortgage gold bonds of 1916	To reimburse treasury for expenditures made	5	6.50	86½
Keystone Power Corp.	1,750,000	Thirty-year	First mortgage gold bonds, series A	.....	6½	6.80	96
Municipal Gas Co. (Albany, N. Y.)	2,000,000	Thirty-year	First mortgage gold bonds, series A	To retire maturing notes and for improvement	5½	5.20	104½
Southwestern Power & Light Co.	3,000,000	One-hundred-year	Gold debenture bonds, series A	.....	6	6.70	89
North American Edison Co.	14,000,000	Thirty-year	Secured sinking-fund gold bonds series A	.....	6	6.60	92½
Total	$55,160,000						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

More Census Returns on Electrical Engineers.—Reading, Pa., had 286 electrical engineers and electricians when the 1920 census was taken. This compares with 170 in 1910. Salt Lake City, Utah, had 471, comparing with 448 in 1910.

Street Lights Held to Be Unnecessary.—The streets of Winlock, Wash., were in darkness recently owing to a ruling by the Attorney-General of the state that street lights were not a necessity and must be discontinued when the city had gone beyond its legal limit of resources. Citizens have taken steps to have the lights again turned on even if the cost of operation has to be met by subscriptions of the taxpayers.

Rochester Considering Ordinance for Licensing Electricians.—Mayor Van Zandt of Rochester, N. Y., has announced that an ordinance for licensing electrical workers now awaiting action will be put up to the people and that opportunities for hearings in the matter will be given. City officials and some of the aldermen hold that the proposed ordinance includes provisions which are unfair. This criticism is made particularly with reference to the requirement that an electrical firm shall have been in business for five years before it shall be entitled to a license.

Electrical Developments in Poland.—The building of a suburban electric railway between Warsaw, the Polish capital, and Modlin is in progress, and the line will probably be opened for traffic this spring. It is intended to be the beginning of a program for the construction of a suburban network of railways around the capital. A bank has been organized for the purpose of developing electrical projects. It plans to exploit the water powers of Silesia, and projects for building hydro-electric plants on the Rivers San and Dunajec have been laid before the Ministry of Public Works. The manufacture of electric lamps, telephones and electrical machinery is also being furthered.

Water Power of Denmark.—Denmark, of course, cannot be compared in the matter of water-power sources with the other Scandinavian nations, and her first experiment with hydro-electricity was not made until 1918. Since then concessions have been granted for three large water-power stations, and plans for one station in Zealand and sixteen stations in Jutland have been submitted to the official committee, which has come to the conclusion that eight of these projects could compete advantageously with steam stations. If seven stations are built in Jutland, they will bring the total rating of electric central stations in that part of Denmark to 18,000 kw.

Edison's Birthday Celebration in Japan.—An elaborate celebration of Edison's birthday was, according to *Denkinotomo*, carried out in Japan, the day "happily coinciding with the 2,852d birthday of the empire." Statesmen, business men, scientists and engineers gathered in Tokyo to honor the occasion, an exhibition was held, motion pictures were taken and an announcement of the birthday was made in every street car. "The translation of the word 'Edison' was happily done as 'Mr. Honorable Knowledge Giver,' which is really characteristic of him," says our contemporary.

"Picking Up" Reservoirs for Hydro-Electric Use.—Among the hydro-electric installations begun in Italy is one on the River Sila, in the province of Catanzaro, Calabria, more than 4,000 ft. above sea level. This project has the advantage of ready-made reservoirs, a number of natural basins supposed to have once held mountain lakes being so situated that they can be utilized in connection with falls giving heads of 1,300 ft. and 1,900 ft. The roseate prediction is made that 168,000 hp. will eventually be obtained by impounding nearly nine billion cubic feet of water, permitting the generation of 800,000,000 kw.-hr. a year.

British Railroads Disagree Over Method of Electrification.—Three English railroads—the Brighton, the London & Southwestern and the Southeastern & Chatham—which had formed a group partnership for the promotion of electrification on their lines, are at loggerheads over the best method to employ. The Brighton lines are being operated by the single-phase alternating-current system and the London & Southwestern by the direct-current method. The latter method has also been specified by the third partner, which has not yet installed electricity. In view of the cost of a change-over by the Brighton road, standardized electrification seems impossible at present.

Georgia Company Plans to Carry on Field Work by Wireless.—Plans to carry on field work by wireless are under way in the territory of the Georgia Railway & Power Company, following the erection of a wireless station in the Electric and Gas Building at Atlanta, and work has already started on the erection of a station at Tallulah Falls. Officials of the company are quoted as saying that if wireless communication between Atlanta and Tallulah Falls proves as successful as is anticipated, stations will be erected at other points of operation. It may prove practicable, they think, to have small field sets carried by the troublemen along the high-tension lines which will permit them to communicate with the office at will.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Northwest Electric Light and Power Association.—The annual convention of this association is to be held in Boise, Idaho, on June 7 to June 10.

Electrical Supply Jobbers' Association.—Hot Springs, Va., has been selected as the place for the next meeting of this association, which will be held on May 24, 25 and 26.

Rhode Island Electrical League Celebrates First Anniversary.—Opportunities for new business and the responsibility of the different branches of the electrical industry in public-relations matters were emphasized at the first annual banquet of the Rhode Island Electrical League, held at Providence March 22. The principal speakers were F. E. Watts, Gage Publishing Company, New York; William Gould, commercial manager Gas & Electric Improvement Company, Boston, and Joseph B. Groce, director New England Bureau of Public Service Information, Boston. Officers were elected for the ensuing year as follows: President, H. J. Pettengill, commercial manager Blackstone Valley Gas & Electric Company, Pawtucket, R. I.; vice-president, F. A. Boss, President Boss Electrical Supply Company, Providence, R. I.; secretary, F. A. Gallagher, Jr.; manager lighting department, Narragansett Electric Lighting Company, Providence; treasurer, R. L. Huse of W. A. Huse & Son, Providence.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Vancouver, April 7; Toronto, April 7.
A. I. and S. E. E. Section Meetings—Cleveland, April 10; Pittsburgh, April 15 and 22; Philadelphia, April 18.
A. I. E. E. Spring Convention—Chicago, April 19-21.
Tri-State Water and Light Association—Spartanburg, S. C., April 19-21.
American Physical Society—Washington, April 22.
American Electrochemical Society—Baltimore, April 27-29.
Missouri Association of Public Utilities—Columbia, Mo., May 4-6.
A. S. M. E. Spring Meeting—Atlanta, May 8-11.
Florida Engineering Society—Daytona, Fla., May 15-16.
N. E. L. A. Annual Convention—Atlantic City, May 15-19.
N. E. L. A Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St Paul, June 13-15.
Electric Power Club—Hot Springs, Va., June 5-7.
Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.
American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.
A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.
American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Contract Entered Into by Electric Plant Prior to Its Dedication to Public Service Not Void.—Premising that the fact that a corporation is, generally speaking, a public service corporation—that is, that its principal business is rendering public service—does not make every act of the corporation the rendition of a public service, the Supreme Court of Washington, in Sunset Shingle Company vs. Northwest Electric & Water Works, declared that where an electric light company before the construction of its plant made a contract with a lumber mill whereby it received the site for the plant and the waste from the mill as fuel in exchange for furnishing steam heat and electricity for power and lighting, as well as repairing the electrical machinery in the mill, the dedication of the electric plant to public service was subject to the contract obligations, so that the contract was not void, even if some of the service to be rendered were public service. (203 Pac. 978.)*

Pre-War Unit of Cost Prices Is Unfair Rate Basis.—Declaring that the rate of return allowed a public utility company should be sufficient to make its securities attractive to investors under all circumstances, the Supreme Court of Appeals of Virginia, in Petersburg Gas Company vs. City of Petersburg, has disapproved the gas rate fixed by the State Corporation Commission and remanded the case to it. The court declares that in determining the rate to which a public utility whose plant is not larger than necessary for the public service is entitled the commission should first ascertain the fair value of the property of the company used or useful in its business, should fix the rate of return which the company is entitled to receive on such valuation above its proper operating expenses, and should then determine the amount to be paid by consumers to pay the expenses and the ascertained return. The cost of reproduction less the observed depreciation is, the court holds, the fairest method of valuation where the utility has not been allowed to earn in the past a depreciation reserve greater than the observed depreciation. The pre-war unit of cost prices is not to be adopted, in view of the known fact that prices have not returned to the pre-war level, and especially where the commission finds there is no probability of such return. The decision asserts also that, though a public utility company is not entitled to relief for losses sustained by it before it applied to the Corporation Commission for increased rates, it is entitled to have losses incurred by it in consequence of a rate fixed by the commission which was too low amortized. (110 S. E. 533.)

Reasonable Rate of Return—Division of Towns Into Two Groups Authorized.—In State ex rel. City of Harrisonville vs. Public Service Commission of Missouri, the Supreme court of Missouri found that the Public Service Commission of that state had power to establish rates higher than those prescribed in a contract between the city and the company by which the city leased its electric light plant to the company, provided that the rates fixed by the commission were reasonable. Rates allowing a return of 6.83 per cent could not, the commission held, be unreasonable. Where the evidence showed that it was impracticable to charge against the various towns served by an electric light company a fixed portion of the expenses of production of the energy at the central plant because of the varying number of customers and quantity of energy used, and that the cost of the energy was greater when the distance of towns from the producing plant was greater, owing to loss in transmission, and that it cost more per customer to furnish a small town than a large one, an order dividing the towns served into two groups and prescribing uniform rates for each group was held to be authorized. (236 S. W. 852.)

Liability of Electric Service Company for Death from Shock When Wire Was Not Installed by It.—In Coleman vs. Iowa Railway & Light Company, a suit for damages because of the death from electric shock of a customer who was endeavoring to connect a washing machine with the circuit by means of a drop cord, it being alleged that current from a high-tension line belonging to the company was carried into the house over the service line, the trial jury found the company not liable, the court having instructed it that if the defendant did not construct or place the service line used by the deceased there could be no recovery. The Supreme Court of Iowa refused to upset the verdict on the claim that this instruction was erroneous, holding that the jury could not have been misled by it as immediately following this direction, and with reference to the same subject-matter, the court proceeded to say it was not necessary for plaintiff to prove that defendant was owner of the line, and that, no matter who was the owner of the line, after it was constructed the company was bound to use ordinary care to avoid unnecessary danger to those who might use the energy, and that failure so to do would be negligence. These directions to the jury, taken in their entirety, involved no prejudicial error, in the opinion of the Supreme Court. (186 N. W. 642.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Abolition of Surcharge.—In abrogating surcharges of 25 per cent still imposed on some classes of customers of the Public Service Electric Company the New Jersey Board of Public Utility Commissioners said recently that, having allowed the surcharge for good and sufficient reason and "it now being apparent from the record that the company is at the present time earning enough without the surcharge to pay its rentals, to pay dividends of 8 per cent on its capital stock, to appropriate an ample amount for amortization of fixed capital, as well as a substantial surplus, the board is of the opinion that with the entire abrogation of the existing 25 per cent surcharge on power bills the company will still have a sufficient net income to assure the continuance of safe, proper and adequate service and to enable it to market its securities and thereby finance the necessary extensions required by the growth of its business."

Federal Income and Excess-Profits Taxes in Relation to Operating Expenses.—The Public Utilities Commission of Hawaii, which had previously, contrary to the views expressed by many other commissions and also to a subsequently rendered decision of a United States district court (see issues of March 12, 1921, page 620, and March 4, 1922, page 451), allowed the Honolulu Gas Company and other companies to include their federal income tax under operating expenses, was recently confronted with an appeal from the gas company against its prior order, in which appeal a similar disposition of the excess-profits tax (now abolished) was requested. The commission said on this point: "We are convinced that Congress did not intend that the excess-profits tax should be shifted to others, for the terminology alone is sufficient to show conclusively that this tax is upon profits and over and above a fair return upon the investment. Is it not rather presumptuous for the company to contend that taxes upon profits which the federal government considers excessive should be passed on to the consumer? The commission is of the opinion that no excess profits should be allowed as a deductible expense. Either the federal government has not allowed the company a sufficient value for its capital investment or the company is earning over and above a fair return upon the amount of its investment—or it would have no excess profit taxes."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

W. H. Zimmerman has been elected president and general manager of the Minnesota Electric Light & Power Company and the Eastern Mountain Light & Power Company, which are controlled by Dodge & Ross, investment bankers of Chicago. Mr. Zimmerman goes to this new position after many

W. H. ZIMMERMAN

years of experience in the design, construction and operation of electric light and power plants throughout the country. He was born in Earlville, Ill., in 1875 and graduated from the University of Illinois as mechanical engineer in 1897. For two years following graduation he was engaged in the design, construction and operation of a power plant for the University of Illinois, after which he became connected with the Big Four Railway as mechanical engineer. He designed, constructed and managed the property of the Urbana Light, Heat & Power Company from 1900 to 1901, then becoming mechanical and electrical engineer with the Arnold Company of Chicago in charge of design, construction and reports on utilities of that corporation. In 1904 he was appointed manager of the De Kalb-Sycamore Electric Company and in 1907 became manager of the Michigan Power Company and also chief engineer in charge of design and construction of the hydro-electric and machine plants of this company. Since 1909 he has followed the engineering profession as consulting engineer in charge of design, construction and operation and management of a large number of industrial and utility properties, excepting fifteen months during the war period when he was connected with Stone & Webster of Boston.

L. F. Harza, consulting hydro-electric engineer, has moved his office from 115 South Dearborn Street to 623 Monadnock Building, Chicago.

William J. Clark, pioneer in the commercial development of electric railways in the United States and a member of the staff of the General Electric Company for thirty-four years, has been appointed advisory manager of the company's railway department.

Dr. R. A. Millikan, director of the Norman Bridge Laboratory and executive chairman of the California Institute of Technology, has been selected as foreign exchange professor to Belgium under the C. B. R. Educational Foundation. Dr. Millikan will leave for Belgium in May.

C. W. E. Clarke, power engineer of Dwight P. Robinson & Company, Inc., sailed for Southampton on March 21. Mr. Clarke will spend about six weeks abroad on one of his periodical inspection trips, visiting the central power stations of England and the Continent and making a study of their design and methods of operation. His itinerary will cover the large stations of England, France and Germany.

William McDevitt, formerly chief of the electrical department of the Progressive Fire Underwriters' Association, and at present holding the title of chief inspector of the Philadelphia Fire Underwriters' Association, was tendered a dinner on his eighty-fourth birthday by representative electric utility men of the Philadelphia district. Mr. McDevitt has served the public in fire prevention for fifty years, and the various speakers of the evening paid affectionate tribute to his long record of service. Perhaps the most appreciated tribute was one in the form of a telegram from Thomas A. Edison.

John J. Carty, chief engineer of the American Telephone & Telegraph Company, has been commissioned a brigadier-general in the Officers' Reserve Corps, U. S. A., upon the nomination of President Harding. Mr. Carty's war record is too full to cite in detail, but his work in the army, in which he attained the rank of colonel and where he co-ordinated all systems of communication and perfected methods whereby cable dispatches could be safely and rapidly sent, is one of the most remarkable of scientific achievements in the great struggle. In recognition he received from General Pershing in France the distinguished service medal and was also decorated by two foreign nations.

C. E. Skinner, manager of the research department of the Westinghouse Electric & Manufacturing Company, has been appointed assistant director of engineering in that company. His duties as assistant director will cover research, standards and other work along these lines. He will be connected with the main engineering office of the company at East Pittsburgh, Pa. Mr. Skinner comes to his new work after years of extensive research work, especially on insulation, and his efforts in this direction have had a marked effect on the development of electrical machine design. He was born near Redfield, Ohio, on May 30, 1865, and was graduated with the class of 1890 from the Ohio State University. In

C. E. SKINNER

that year he joined the Westinghouse organization in the controller department and supervised the construction of the first controller turned out by the company. Soon after he was placed in charge of the testing of insulation, and in 1892 he was transferred to the research laboratory. In 1895 Mr. Skinner was placed in charge of insulation design in the engineering department, taking charge in 1902 of the insulation division of this department together with the chemical and physical laboratories. Four years later he organized the research division, of which he was in charge until his present promotion. Mr. Skinner has contributed frequently to industrial literature and is well known for his researches abroad as well as in this country. In 1915 he was a special representative of the American Institute of Electrical Engineers, of which he is a fellow, at the international conference on electrical standards held in London, and he is now a member of the committee representing the Institute in the International Electrotechnical Commission. He was chairman of the American delegates to the Brussels meeting in 1920. During the war Mr. Skinner was a member of the National Research Conference and also a member of the advisory council of the division of engineering.

Samuel G. Hibben has recently been appointed manager of the illumination bureau of the Westinghouse Lamp Company, 165 Broadway, New York. In this position he will have charge of matters in connection with incandescent-lamp applications, lighting specification practice, and in general all activities of the Westinghouse companies that are connected with technical lighting service. Mr. Hibben is an electrical engineering graduate of the Case School of Applied Science, Cleveland, and the Sorbonne, Paris. He has been closely indentified with illumination practice in the designing of new lighting devices and is prominently known from his written contributions to the technical press and his position in the

S. G. HIBBEN

Illuminating Engineering Society, as well as for his activities in the N. E. L. A., the A. I. E. E. and others. During the war he was identified with field searchlight engineering in Washington, and later he operated with the Engineer Corps in France on anti-aircraft lights. He retains his military status as captain of engineers, R. C. His former activities include five years as illuminating engineer of the Macbeth Evans Glass Company, Pittsburgh; meter-design engineer for the Westinghouse Electric & Manufacturing Company; consulting engineer, Pittsburgh; war reparations engineer with the Peace Commission, France, and several years as illuminating engineer for the Westinghouse Lamp Company at Bloomfield and in New York.

W. J. Metcalf has been chosen as assistant to the president of the Yale & Towne Manufacturing Company, manufacturer of electric industrial trucks and other products, Stamford, Conn.

S. B. Bechtel, formerly vice-president and general manager of S. F. Bowser & Company, Inc., Fort Wayne, Ind., has succeeded S. F. Bowser as president. Mr. Bechtel has been with the company for twenty-three years, entering its employ in 1899 in the collection department. In 1907 he had attained the position of secretary and in 1914 was made general manager. In 1920 he was made vice-president and general manager.

William J. Morris has been elected treasurer of the Youngstown (Ohio) Sheet & Tube Company, succeeding Richard Garlick, who has resigned on account of ill health.

Charles Wiggin of Dunham, Carrigan & Hayden, San Francisco supply jobbers, has been elected president of the Pacific Coast Division of the National Electric Supply Jobbers' Association.

George E. Learnard, president of the International Combustion Engineering Company, New York, sailed March 21 for London on the Aquitania. He will proceed to the Continent when he has finished his business at the London office of the company.

H. C. Hopkins has resigned as head of the promotion and advertising division of the San Francisco office of the Westinghouse Electric & Manufacturing Company to assume active partnership in the advertising firm of Dolman & Hopkins. For the past fifteen years Mr. Hopkins has been associated with the Westinghouse company in the manufacturing, sales, advertising and sales promotion department and during that time has been active in co-operative work with other branches.

G. H. Pfeif has been appointed director of industrial relations at the Schenectady plant of the General Electric Company, succeeding E. B. Merriam, who recently became executive engineer of the switchboard department. As director of industrial relations Mr. Pfeif will have supervision over the employment, education and training, compensation, hospital and safety work of the Schenectady plant. He has been with the General Electric Company since 1905 and for several years past, as secretary of the committee on student affairs, has been in charge of the selection and placing of technical graduates in the student engineering courses of the company. He was born in Terre Haute, Ind., and was graduated from Rose Polytechnic Institute in 1905. The same year he entered the testing department of the General Electric Company. In 1906 he was engaged in the office of the testing department and in 1909 was employed in the office of the general superintendent. The following year he was engaged in engineering work in the Western Electric engineering department at Schenectady. Since then he has given the greater part of his time to the problem of technical education and the engaging of student engineers for work with the company. In this capacity he has visited universities all over the country, selecting the most promising material and co-operating with the other works of the company in the conduct of the student engineering course familiarly known as "the test." During this period Mr. Pfeif was closely associated with President E. W. Rice, Jr., and Francis C. Pratt, vice-president in charge of engineering.

J. M. Fried, who was recently elected president of the Mississippi State Association of Electrical Contractors and Dealers, has been in the contracting industry at Vicksburg, Miss., since 1915. After graduation from the electrical engineering course at Cornell University in 1907, he became connected with the Edison Lamp Works at Harrison, N. J., and served as traveling illuminating specialist in placing the tungsten lamp on the market. In 1910 he joined the Poughkeepsie Light, Heat & Power Company as new-business manager. After staying there a year he accepted the position of electrical engineer for the Massachusetts Lighting Company, Boston. In the summer of 1912 he entered the employ

J. M. FRIED

of the Worcester Light & Power Company and became its power engineer. Removing to New Orleans in 1913, he joined the engineering staff of the H. W. Johns-Manville Company and continued with this firm until he opened an electrical contracting house at Vicksburg in 1915.

Ogden R. Adams has been re-elected president and general manager of the Seneca Falls Manufacturing Company, Inc., Seneca Falls, N. Y.

Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, has returned from a trip to Europe and the Near East.

Obituary

William Warren Crosby, a consulting mill engineer of Boston and partner in the firm of Haven & Crosby, died at Arlington, Mass., March 19. He was born in Arlington in 1871 and was educated at the Massachusetts Institute of Technology. For several years he was affiliated with the F. W. Dean Company of Boston in power-plant and mill practice, and prior to that was principal of the Lowell (Mass.) Textile School and also associated with various textile mills.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Blow at Jobber in Mennen Decree of Trade Commission

WHAT is regarded as a move most inimical to jobber interests has just been made by the Federal Trade Commission in its decree directing the Mennen Company to "cease and desist from discriminating in net selling prices, by any method or device, between purchasers of the same grade, quality and quantity of commodities, upon the basis of a classification of its customers as jobbers, wholesalers or retailers, or any similar classification which relates to the customers' form of organization or business methods." Another provision of the order states that nothing contained therein shall prevent discrimination between purchasers on account of grade, quality or quantity or the making of due allowance for differences in sale and transportation costs or price changes made in good faith to meet competition.

The decree is the first application of Section 2 of the Clayton act to price discrimination of the sort prohibited and is considered a test case. If upon review by the higher federal courts it should be sustained, it is clear that a revolution in the distribution system of the country would be necessitated and jobbers of all sorts of commodities would be summarily put out of business. This opinion is expressed by counsel for the Mennen Company, and it is also stated that the commission has indicated all through the matter that the action has been taken in an amicable spirit and merely with the intention of clearing up the law on this phase.

In this particular case the respondent was accused of treating unfairly organizations which bought on a co-operative or mutual basis, chain stores, department stores and other organizations which bought in quantities as large as jobbers but could not obtain jobbers' discounts. This condition is not met with so frequently in the electrical field, where department stores are the only organizations as a rule buying appliances in as large amounts as jobbers and where few contractor-dealers buy heavy stocks. However, it is conceivable that the sustaining of this decree might very easily lead to the formation of such co-operative buying organizations within the electrical industry. It is expected that this decree, fraught with so much significance to jobbers in every line, will be appealed and settled speedily.

February Electrical Exports Only Slightly Under January

ELECTRICAL exports for February may be considered to have held about even with those in January. It is true that the February total, $4,184,677, is $88,571 below the January total, but it must be taken into consideration that February is a short month and in some sections of the country has more than its share of holidays. But while it is evident that the two months differed very little as far as export conditions were concerned, there is little in that fact for electrical manufacturers to exult over. February, 1921, saw more than 300 per cent more electrical goods exported than did this February, and even February, 1920, had 50 per cent more electrical exports.

Comparison, item by item and period by period, will be practically impossible until the new classification has been in effect a year. There have been slight fluctuations in the

ELECTRICAL EXPORTS FOR FEBRUARY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	February, 1921, Value	February, 1922, Value
Electrical glassware, except for lighting		$22,168
Electric porcelain		194,455
Carbons for electric lighting, electrodes and batteries	$62,337	30,536
Insulated wire and cable (iron and steel)		11,867
Other manufactures of aluminum	355,641	56,415
Copper wire (bare)	333,344	71,770
Insulated copper wire and cable	1,123,873	158,078
Generators:		
Direct-current—		
Under 500 kw.		34,631
500 kw. and over		12,189
Alternating-current—		
Under 2,000 kw.		3,009
2,000 kw. and over		49,624
Accessories and parts for generators		18,412
Self-contained lighting outfits		22,498
Batteries:		
Primary—dry		72,770
Primary—wet		718
Storage		84,516
Transforming or converting apparatus:		
Power transformers		231,431
Other transformers		119,397
Rectifiers		1,320
Condensers, double-current and motor-generators, dynamotors, synchronous and other converters		56,148
Transmission and distribution apparatus:		
Switchboards and panelboards, except telephone		43,063
Switches and circuit breakers		177,613
Fuses and fuse plugs		13,181
Watt-hour and other measuring meters		68,672
Volt, watt and ampere meters, other recording, indicating and testing apparatus		40,353
Lightning arresters, choke coils, reactors and other protective devices		20,907
Motors, starters and controllers:		
Motors under 1 hp.		30,612
Stationary motors—		
1 hp. to 200 hp.		169,604
Over 200 hp.		54,271
Railway motors		19,963
Electric locomotives—	$123,325	
Railway		
Mining and industrial		$36,329
Other motors	2,426,433	38,655
Rheostats, controllers and other starting and controlling equipment	114,235	63,697
Accessories and parts for motors		57,859
Electric appliances:		
Electric fans	309,373	77,229
Electric lamps—		
Arc	1,234	770
Incandescent—		
Carbon filament	14,804	8,204
Metal filament	597,917	120,830
Other electric lamps		13,888
Flashlights		11,077
Searchlights and projectors		34,567
Motor-driven household devices		39,259
Domestic heating and cooking devices	381,742	30,511
Industrial electric furnaces and ovens		2,647
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.		33,855
Signal and communication devices:		
Radio and wireless apparatus		283,950
Telegraph apparatus		17,688
Telephone apparatus, including telephone switchboards		430,559
Police, fire and burglar alarm apparatus		1,637
Railway signals, switches and attachments		9,338
Bells, buzzers and annunciators		2,641
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	159,513	55,159
Insulating material		50,561
Metal conduit, outlet and switch boxes		24,005
Sockets, outlets and receptacles		13,795
Other wiring supplies and fixtures	377,540	74,063
Other electrical apparatus not elsewhere specified	3,601,491	711,713
Total	*	$4,184,677

* Total electrical exports for February, 1921, amounted to $13,632,478. This figure is not included in the above table on account of the incompleteness of figures for that month under the new classification.

total of various items from January totals, but none of a great deal of importance. The following items for the month stand out as good: Electric porcelain, $194,455; insulated copper wire and cable, $158,078; power transformers, $231,431; switches and circuit breakers, $177,613; stationary motors, $223,875; radio apparatus, $283,950; telephone apparatus, $430,559.

Lamp List Prices Down 10 to 12 per Cent

MANUFACTURERS of large incandescent lamps have announced a readjustment in list prices of substantially all sizes of type B and type C lamps, which becomes effective on April 1. The change in list quotations results in a reduction of approximately 10 per cent in the prices of the lamps used principally by commercial and residential customers and a maximum decrease of 12½ per cent in the prices of the standard 10-watt to 50-watt type B lamps, which are the types principally used in the residential field. This price readjustment follows a reduction of approximately 10 per cent in the list prices of type C lamps which became effective about six months ago. There is no change in the discount schedule and it is stated that none is contemplated. List prices of miniature lamps remain the same.

The reductions on the most popular sizes are as follows: Type B, general, 25-watt clear, from 40 cents to 35 cents; 40-watt clear, from 40 cents to 35 cents; 50-watt clear, from 40 cents to 35 cents; 60-watt clear, from 45 cents to 40 cents; type C, general, 75-watt clear, from 80 cents to 70 cents; 100-watt clear, from $1.05 to 95 cents.

Copper Wire Sales Showing Steady Improvement

ORDERS for copper wire, both bare and insulated, have shown a steady increase since the first of the year, and wiredrawers are experiencing more activity than at any time during the past year, according to a number of large manufacturers recently interviewed by a representative of the ELECTRICAL WORLD. This applies only to domestic business as exports of wire have been falling off every month since last summer. Manufacturers state that public utilities are buying large quantities of transmission cable for maintenance as a result of the recent successful flotation of bond issues. Weatherproof wire has also sold in good volume to central-station companies.

Demand for lead-covered cable is gaining slowly, though until three weeks ago it fluctuated a great deal, many orders being received on one day and only a negligible few the succeeding three or four days. At the present time orders remain small, but they are coming in more steadily and producers have indulged the hope that from now until summer the market will lose its spasmodic characteristics. This better business, it is admitted, is due somewhat to seasonal influence, spring and summer being the time when most cable contracts are closed. One producer declared that, judging by recent inquiries as well as orders, this will probably be a good year for domestic cable business.

Another source of demand has been the telephone and telegraph companies, which have never ceased extending lines, even in a period of slack business, and are always in the market for a large quantity of wire for the purpose of making repairs. There has also been a heavy call for magnet wire, due to the growing public interest in wireless telephony. This was first confined to the East but spread rapidly to the Middle West and the Pacific Coast, and within the last two weeks several large orders for magnet wire have been received from the South.

The construction industry has taken large amounts of rubber-covered wire in the last month, much of this demand being confined to the No. 14 gage. Residence building continues to climb in almost all localities, and the demand for rubber-covered should remain very good for at least the next six months.

Foreign orders for wire of all kinds remain disappointingly small. Europe, South America, China and Japan took large amounts under normal conditions, but since the first of the year Europe and the East have not been so strongly in the market. South America is still taking good quantities of insulated wire. Brazil especially has been in the market for wire for power transmission and rubber-covered wire for building. Chile has given American wiredrawers more business in the first three months of 1922 than during any similar period, and there has been an increase in business with Colombia and Venezuela. Electrification of foreign railroads and proposed electrification of a 65-mile stretch of American railroad have been responsible for some activity in the market for wire and rail bonds. A great deal of electric railway repair work is going ahead at the present time after having been held back for several years, and this has resulted in good business for wiredrawers.

Prices of the various types of wire, after fluctuating with the copper market for a period after the first of the year, have steadied somewhat, though they have not advanced appreciably. Competition on No. 14 rubber-covered wire has been very keen, owing to the large number of manufacturers in the field, and average quantities are reported to be available under the nominal jobber quotation. The situation is not so serious, however, as it was last fall, when stocks were large and demand was relatively small.

Metal Market Situation

DURING the past week the copper market settled down and lack of demand from both domestic and foreign consumers characterized trade. A number of consumers reported that they had been able to obtain copper for delivery through May at 12¾ cents per pound, but this could not be confirmed among the producers, who averred that they were obtaining 12⅞ cents for that delivery. Domestic business has dropped off more than has foreign. Encouragement is to be found in the fact that while orders booked have shrunk, deliveries against previous orders continue to be very good.

The statistical position of the metal is improving steadily. At the beginning of this week March sales into foreign consumption totaled probably 50,000,000 lb., while sales into domestic consumption probably aggregated 60,000,000 lb. During January and February stocks of refined copper were reduced about 80,000,000 lb. and blister about 85,000,000 lb., so that at the beginning of March stocks of refined copper totaled about 370,000,000 lb. and blister approximately 215,000,000 lb. The Copper Export Association still has about 220,000,000 lb. to dispose of, so that April 1 should see only about 100,000,000 lb. of refined copper available to the domestic market.

The aluminum market is somewhat stronger this week because of advanced prices and better demand abroad. Aluminum company prices have not advanced but those of outside sellers are about ¼ cent a pound higher. Demand for lead continues very good, and at present large inquiries are in the market for prompt and April shipment, with, however less tonnage than is usually booked on contracts. Some producers have had so many orders booked at 4.45 cents East St. Louis, April delivery, that they have practically withdrawn from the market.

NEW YORK METAL MARKET PRICES

	March 21, 1922	March 28, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	59 2 6	57 12 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00–13.25	12.87½
Electrolytic	13.00	12.62½
Casting	12.62½	12.37½
Wire, base	14.00–14.25	13.87½–14.12½
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.25	4.40
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	7.50
Zinc, spot	5.05	4.97½
Tin, straits	29.00	29.25
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.00 –11.25	10.75 –11.12½
Brass, heavy	5.00 – 5.50	5.00 – 5.50
Brass, light	4.75 – 5.00	4.75 – 5.00
Lead, heavy	3.75 – 3.87½	3.75 – 3.87½
Zinc, old scrap	2.25 – 2.50	2.37½ – 2.60

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A WEEK of slight change and moderate activity succeeded the constant improvement noted in the beginning of March. Building is flourishing everywhere, but most of it seems to be of residences, as has been the case for the past year. Construction prospects appear good in St. Louis, where several of the building trades have accepted wage reductions. Jobbers there report that industrial business is not so bad as it is reported and that several specialties are leaving stock in good volume. In New England basic conditions continue to show improvement, but the textile strike is spreading, and that in itself constitutes a hindrance to business. However, wiring supplies are moving there and prices have stiffened on "Nail-it" knobs and pull sockets. Atlanta has witnessed a slight pick-up in electrical jobbing, and crop prospects there are improving. The 10-amp., two-wire house-type meter is proving popular there. From Utah comes the good news that the Apex mine at Bingham, one of the largest lead and silver mines in that section, will start operations immediately with the employment of 500 men and that the Utah Copper mine will probably have 300 to 400 men employed and five steam shovels in operation by April. Building and retailing have slowed up slightly, but a strenuous electric range campaign is in preparation there. Alaska electrical business is reported to be picking up, with two large private power plants planned there. Prices have dropped 5 per cent in Seattle on loom, friction tape and strain insulators.

NEW YORK

Business in the electrical trade continues to show gradual improvement and jobbers in this section expect that March sales will show up much better than those for February. The increase in residential building activity has been chiefly responsible thus far for the demand for wiring supplies. Indications, however, point to the resumption of commercial construction, as already excavations have been started for a number of buildings in the business sections. Activity along industrial lines still lags, but this should not be taken too seriously, as many industrial plants have no immediate need for further expansion. With the exception of lamps, on which a reduction of approximately 10 per cent becomes effective April 1, there was no change in the general line of prices.

Appliance sales are somewhat better, and jobbers report that dealers are increasing the quantity of individual orders. Vacuum cleaners and washers also show a slight improvement. Advance orders for fans have come through very well, and jobbers appear to be well satisfied with the volume of business already contracted for.

Radio outfits and parts are still in strong demand, and jobbers have been unable to build up any stocks. The demand appears to be equally great for separate parts and for complete sets.

With the increased activity in wiring materials and the advent of the wireless apparatus business, electrical credit men state that they are exercising unusual care in opening new accounts and extending credits. Collections show little change, running from forty-five to sixty days for current billings.

Rigid Conduit.—Demand has been moderate but steady, with no change in prices. Jobbers' quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50; ¾-in., $58.10, and 1-in., $82.79 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $50, $64.50 and $92.20 per 1,000 ft. Stocks are ample to meet the existing demand.

Rubber-Covered Wire.—Sales have been fair the past week and prices have been steady with no tendencies to weaken. Quotations on No. 14 rubber-covered range from $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks generally are in good condition.

Flexible Armored Conductor.—The latter part of last week saw some price cutting on this material and quotations dropped to almost $40 per 1,000 ft. on No. 14, single-strip. However, prices have stiffened sharply and the lowest quotation on No. 14, two-wire, single strip, was $42.50 per 1,000 ft. in that quantity and $45 per 1,000 ft. for double strip. Demand has been very active because of the increase in building activity, but jobbers' stocks seem to be in fairly good shape.

Lamp Cord.—Demand has improved moderately while prices remain stationary. No. 18, cotton, twisted, is quoted from $11.65 to $12.75 per 1,000 ft. in that quantity. No. 18, cotton, parallel, is quoted at $14.50 to $15.45 per 1,000 ft. Stocks are fair to good.

Tape.—Friction and rubber tape are both quoted at 36 cents per pound in 100-lb. lots. Demand is somewhat better along with items of wiring supplies.

Loom.—This material, never very active in this territory, is moving slightly better. In 1,000-ft. lots the ⅜-in. size sells for $13.50 to $14 per 1,000 ft. The ½-in. size is quoted at $16.20 to $16.50 per 1,000 ft.

Fans.—From present indications this should be a very good year for fans. Jobbers, who last week stated that their fan business was then equal to last year's, report that orders are still being placed by dealers, whose total initial orders now show a considerable increase over those for 1921.

CHICAGO

Only slight changes in the electrical trade have been noticed during the week. The call for wiring materials, while not showing any remarkable spurt, is gradually increasing. Small orders are prominent and price competition is still continuing. A good movement of No. 14 bare wire is being caused by the demand for radio equipment. The radio business is increasing daily. All stocks are low in the appliance lines. Ironers have been selling well and some good business on washing machines and vacuum cleaners has been produced by strenuous and persistent sales efforts.

Flexible Armored Conductor.—Most jobbers report a sustained steady business on this conductor. The No. 14 two-wire single-strip in 5,000-ft. lots is available at prices varying from $42.50 to $43 per 1,000 ft. Dealers' stocks are fair but not excessive.

Rigid Conduit.—Only a fair call is noted for this material, and the keen price competition has forced prices down until the 72-in. black pipe is available at $40 to $41 per 1,000 ft. in 5,000-ft. lots. The supply of conduit is good.

Wire.—The movement of wiring materials has maintained its steadiness of the past few weeks, and few jobbers report an increase in sales. The bulk of sales is of the small-order variety, very few dealers buying in large quantities. No. 14 rubber-covered wire is selling around $6.35 per 1,000 ft. in 5,000-ft. lots. Stocks are ample. The demand for bare wire is still continuing, especially for sizes around No. 14, because of radio requirements. Weatherproof wire is moving steadily, but with few pronounced large sales. Stocks of weatherproof and bare wire are in fair condition. No price changes have been noted.

Fans.—Nearly all dealers have signed up their contracts and are putting in good stocks, the 1921 fan business having reduced stocks very appreciably.

Heating Appliances.—While this market has fallen off, it is not actually sluggish, a few dealers still reporting good activity on ironers, curling irons and grills. Open-air heaters are moving slowly.

BOSTON

A pronounced betterment in basic conditions continues except in the textile field, where labor troubles have not abated. Further wage reductions in the Merrimac Valley have been followed by walkouts, and so far general resumption of production in other areas suffering from strikes has been delayed. Building operations are opening rapidly with favorable weather. In thirty-four Massachusetts cities building permits in February exceeded those of January by 14.7 per cent and exceeded February, 1921, by 92.4 per cent. Building and engineering contracts in New England for the week ended March 21 totaled $7,225,000, compared with $4,097,300 for the same week last year. Some improvement appears in the paper and shoe manufacturing industries, and in the metal field an upward trend in business is evident. Electrical supply jobbers report that business maintains considerable vitality, wiring supplies moving a little better and radio equipment, as usual of late, being in great demand. Prices stiffened last week on pull sockets and "Nail-it" knobs. A turn for the better is reported from a large electrical porcelain plant in western Massachusetts. Little anxiety is apparent as yet regarding the threatened coal strikes, leading New England utilities having from two to three months' supply on hand April 1.

Sockets.—Prices increased on pulls last week in case lots from 31½ to 32 cents net out of Boston stock. Keys and keyless sockets also have risen ½ cent, the former moving at 18½ cents and the latter at 17 cents. Competition is sharp for moderate volumes of business.

Shade Holders.—Discounts have been cut on less-than-carton lots on certain types of schedule material, such as plates and shade holders, to encourage carton-lot purchases. The new discount on less-than-cartons is 33⅓ per cent off double-list against 40 per cent previously, the carton and standard package discounts remaining at 50 and 57½ per cent respectively.

Radio Equipment.—The demand for radio-telephone sets and aërials is rapidly increasing, and new distributing agencies are coming into the field. Stocks cannot be built to any size under the present demand, but some jobbers look upon this as no great evil in view of the development work in progress in the design of radio apparatus. Prices are none too easily maintained, and the prospect for cheaper sets for wide distribution is receiving some discussion.

Fixtures.—The demand quickened somewhat toward the end of last week. Business is extremely varied and somewhat spotty.

Lamp Cord.—Moderate sales are reported, with good stocks. No. 18 cotton-covered cord is quoted around $22 per 1,000 ft. in less-than-coil lots, $17.50 per 1,000 ft. in 250-ft. to 1,000-ft. lots, and $14.50 in 1,000-ft. to 5,000-ft. lots.

Wire.—The market is non-spectacular. No. 14 rubber-covered wire is selling at $6.25 per 1,000 ft. in 5,000-ft lots, building requirements taking fair quantities in irregular orders. Central-station extension work is picking up a bit in the weatherproof line.

"Nail-it" Knobs.—These rose from $14 to $15.50 per 1,000 in barrel lots last week, the demand being fair. The outlook for porcelain movement is perceptibly better.

ATLANTA

Improved weather conditions have lent a more optimistic tone to business in general, and while building construction has not been under way sufficiently long to stimulate buying to any great extent, nevertheless anticipation of better conditions is being reflected in the pick-up in the building material and electrical jobbing lines. Business in the cities continues to be fairly satisfactory, as illustrated by the building permits for February in the seven leading Southeastern cities, the valuation amounting to $4,058,806 as against $1,974,804 for the same month in 1921. Activities in the rural sections are still at a low ebb as inclement weather brought all farm activities to a standstill and the ground is still too wet to be worked. Money is very scarce in the small centers and business of course is very sluggish as a result. The peach crop in middle Georgie has bright prospects, there having been no killing frosts to date, and unless some unexpected event occurs, this section should be in fine shape within the next ninety days.

Poles.—The movement of poles can be reported as only fair, spring construction not yet having got under way. Prices remain steady with yard shipments fairly good.

Floodlighting Equipment.—Little or no activity has been reported in this line for several weeks past, the purchases being very scattered and of small volume. Local stocks and shipments are both reported as satisfactory, with prices steady.

Pole-Line Hardware.—Like poles, this line is not moving as well as was anticipated, though the activity is greater than in the pole line.

Lamps.—The past winter has seen a very satisfactory turnover, but approaching summer is, as usual, reducing the volume of sales. Jobbers have stocks of all sizes on hand in ample quantities.

Dry Batteries.—The volume of sales is considerably reduced, the bell-ringing transformers having cut into their usage in the cities and the dullness in the automobile and stationary-engine trades in the rural districts having curtailed that market.

Battery-Charging Outfits.—A slight improvement is to be noted in this line, the second-hand equipment which was on the market in such quantities six months ago seeming to have been about absorbed. Sales, however, have not yet returned to the basis of eighteen months ago. Local stocks are reported quite satisfactory.

Meters.—A fairly satisfactory turnover is reported, with the 10-amp. two-wire type growing in popularity. A number of the largest companies show a tendency to standardize on this type, instead of the 5-amp. Local stocks are in fine shape throughout the entire range of sizes.

ST. LOUIS

Further wage reductions in the building trades were announced last week, the concrete workers, laborers and excavators having made agreements on the basis of about 15 per cent lower than last year's scales. The carpenters were also notified by the contractors that, effective April 1, the wages paid them would be reduced from $1.25 per hour to 95 cents per hour. It is quite possible that resistance will be made to this reduction. The reduced labor costs are stimulating construction activity, but the full effect of it has not yet reached the electrical interests.

A good indication of the expected electrical development in this territory is the announcement made last week by the Union Electric Light & Power Company of its plans to start construction immediately on a 240,000-kw. power plant, 60,000 kw. of which are to be available in about eighteen months and another 60,000 kw. within four years thereafter. The construction has been deferred as long as possible, but the continued growth of power and lighting business has made the additional power imperative.

Jobbers report business better than a month ago and continually improving. The general public seems more willing to spend now, and the industrial concerns, with business better, are more inclined to make necessary improvements in their plants. One jobber predicts that this fall will see business as good as it has ever been in normal times. However, until that condition obtains all jobbers are from necessity maintaining stocks at the minimum consistent with giving good service.

Washing Machines.—The distributors of one well-known machine are making a special price reduction of about $25 and as a result are moving machines in good volume. Other distributers report that business shows improvement. Dealers have increased their stocks to some extent, and jobbers are maintaining a satisfactory amount on hand.

Vacuum Cleaners.—With the advent of spring the demand for cleaners is showing a healthy condition for the first time in months. What business was formerly found was quite spotty, but all jobbers now report steady sales. Local stocks are maintained at a minimum.

Lamps and Fixtures.—With increased building and more manufacturing, the demand for lamps continues to be very active. A large manufacturer last week gave demonstrations of the value of the various types of lighting equipment for industrial and commercial purposes and succeeded in creating considerable interest in improvement of lighting conditions, but there has been insufficient time to note any appreciable effect on sales.

Radio Equipment.—With the increased public interest in broadcasting service, the demand is increasing in proportion. Sales are apparently limited only by the slow deliveries, but on account of the delivery condition it is possible that there are a good many duplications of orders.

PORTLAND—SEATTLE

General business conditions show little change from week to week. Reports, however, indicate an earnest struggle on the part of industry to get fully under way, with varying degrees of success. While those well informed in business circles are optimistic as to the future, no spectacular improvement is looked for. Alaska has been pretty dull for the past year and a half, but business there is beginning to go forward again. A Seattle engineering firm which does a great deal of work up and down the Alaskan coast states that pulp and paper as well as canning interests are developing one small and one moderate-sized power project, with work to begin this summer. The employment situation shows signs of improvement throughout the Northwest.

Building construction, which is quite active, creates a demand for certain kinds of electrical material. This demand is reflected particularly in house wiring and fixture sales. Sales of electrical appliances, with the exception of ranges and vacuum cleaners, continue to be rather sluggish.

Electrical jobbers report that activity in general materials is somewhat improved, although still only moderately good. Bad weather has delayed some work that would otherwise have developed. Demand for radio material is far in excess of the supply and apparently will continue to be for some time. The only price changes during the week were drops of about 5 per cent on loom, friction tape and cement strain insulators.

Vacuum Cleaners.—The market on cleaners has been rather quiet since Christmas time. Prices are firm.

Washers.—Sales of washers have picked up somewhat during the past weeks. The last price adjustments reported were made effective about March first, but considerable diversity in quotations still exists.

Ranges.—A somewhat better tone in ranges exists as indicated by improved sales. A new type of automatic range with definite temperature and time adjustments has just appeared. Prices on these ranges are $223 and $245 for the open and closed element types respectively.

Flatirons.—The new type of iron provided with automatic cut-out has just appeared on the local market and seems to have been well received. The new 6-lb. automatic sells at $8.89 as compared with the old type at $6.75.

SAN FRANCISCO

Many larger buildings have reached a stage where they are ready for electrical material. Building is good, but retail business slowed up during March. Most dealers report inordinately low daily receipts and are inclined to blame it on the income tax and municipal tax. Government business is small because of the uncertainty attending the future policy in the Pacific. State business is very good, with a great amount of scattered building on state projects such as hospitals and office buildings, on which the bidding is exceedingly keen. Country business is rather quiet. This is the off-peak buying season for the country, for the banks are rather cautious with loans before May of each year.

Local stocks have been low occasionally, but Eastern shipments both by rail and by boat have been so prompt and stock systems have been so well organized in these days of hand-to-mouth buying that a constant succession of small shipments from the factory rather than a few spectacular large ones is now the rule.

Ranges.—Within the next thirty days it is figured that an active campaign will be begun based upon range list prices, with an equal chance for the central-station company and dealer to make the same profit on each sale to the consumer. Various systems based upon cost at a small profit to the central station, with the virtual elimination of the dealer, have been tried out during the past six months, with the object of popularizing electric ranges without considering profits, but the result has been to emphasize the need of dealer co-operation.

Water Heaters.—A campaign such as the above will also include water heaters, which, on account of rate provisions, carry a sliding scale that helps the entire installation. It is noteworthy that during 1921 the percentage of increase of water-heater installations was almost triple that of the increase in range installations.

Flexible Conduit.—Non-metallic flexible conduit is selling about 50 per cent better now than during the average 1921 month. Stocks and shipments are all that could be desired. Metallic flexible conduit is in spotty demand in some districts, such as San Francisco, where the half-inch conduit style is requested instead of the twisted-wire style conduit. Orders placed for carload shipment from the East run about one-quarter of the entire demand, the balance being in smaller lots for shipment out of Coast stocks. Sales are very good.

Boxes and Covers.—Here is one roughing-in line on which there has been an occasional shortage. Stocks are satisfactory now, however.

Schedule Material.—The convenience-outlet campaign inaugurated in California and intensified by such publicity as that accomplished by a well-distributed series of electrical homes has resulted in new and standardized designs which are ready for distribution now. Definite increases are noted from month to month in demand and in public interest.

SALT LAKE CITY—DENVER

Beginning April 1, there will be a gradual resumption of copper production in Utah. On that date the first five hundred of thousands of men who have been idle for one year will go back to their jobs, and it is expected that the ranks of the unemployed will be steadily depleted. Since these mines operate electrically, this is big news to the electrical industry in the Intermountain region. From the central station to the smallest jobber of supplies business is sure to show a better volume. This would enable distributers of supplies to thin out their stocks in lines that of necessity have been held in abnormal quantities. Besides toning up the electrical market, the resumption of work in the copper mines should have an invigorating effect on business generally.

Other hundreds of unemployed men are being absorbed in construction projects, both municipal and state. The weather is favorable in many parts for the launching of building programs that have been pending throughout the winter months. Real estate firms are unusually active, one concern alone announcing that it has available for building of homes $1,000,000 of insurance company money. When the Intermountain States get their road-building programs under way it is believed that non-employment will become a thing of the past.

A more favorable money market is reflected in a steadily declining interest rate, and it is easier to contract loans than it has been in the past two years. Some improvement in collections is being noted. The beet-sugar industry is getting back to something like a stable basis and the wool market is exceptionally strong, showing prices from 50 to 100 per cent above those at shearing time last year.

Ranges.—Retail sales are at low ebb. Summer is the season for the movement of electric ranges, and jobbers and dealers are preparing accordingly. There has been advance notice of reduction in price in some lines and this is counted on to stimulate sales.

Flatirons.—Movement of irons is steady and consistent, though no records for volume are being broken. The emphasis that was put on reduced price several months ago has shifted to improved mechanical features with good effect.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Kelman Electric & Manufacturing Company Enlarges Plant

The Kelman Electric & Manufacturing Company of Los Angeles, manufacturer of oil switches, has completed the construction of an addition to its factory which was necessitated by the largely increased demand for oil switches. With the increase in facilities the organization of the company was also increased, and plans are being made to supply a market which is expected to be very active.

Larger Quarters for Chicago Radio Company

The Chicago Radio Apparatus Company increased its floor space about five times when it recently opened a new store at 415 South Dearborn Street. C. C. Klentz, the manager of this company, told a representative of the ELECTRICAL WORLD that he had added four persons to his office force in order to take care of the demand for radio equipment. Mr. Klentz also stated that his stocks for building radio sets were in good condition and that he was now receiving his shipments on past orders.

Irvington Varnish & Insulator Under New Control

A complete change has taken place in the ownership of the common stock of the Irvington Varnish & Insulator Company, Irvington, N. J., according to an announcement made by D. Frederick Burnett, treasurer under both the old and new managements. The entire issue of the stock has been acquired by a syndicate composed of William F. Hoffmann, Arthur E. Jones and Carl Egner. The estate of Carl Berger and a Miss Heinrichs, Mr. Burnett stated, are no longer interested in the stock.

A new board of directors was elected at the annual meeting held March 21 and includes two members of the old board, Andrew Young and D. F. Burnett, as well as Messrs. Hoffmann, Jones and Egner. Officers were elected as follows: Mr. Jones, president; Mr. Hoffmann, chairman of the board and vice-president; Mr. Young, vice-president; Mr. Egner, secretary, and Mr. Burnett, treasurer. Mr. Hoffmann has numerous other business connections and is actively connected with the American Oil & Supply Company. Mr. Jones has been vice-president and sales manager of the American Supply & Oil Company, but henceforth will devote practically his entire time to the duties of his position as president of the Irvington Company. Mr. Young remains as general manager as well as vice-president and will have charge of production, in which he has had long experience. Both Mr. Egner and Mr. Burnett are actively identified with several other manufacturing and business institutions.

Alpha Electric Buys Out Westinghouse Agent-Jobber

Announcement has been made by the Alpha Electric Company, electrical jobber, 151 West Thirtieth Street, New York, that it has bought the stock and good will of the Northwestern Electric Equipment Company, 379 Washington Street, New York. The Alpha company by this move becomes Westinghouse agent-jobber in the metropolitan district instead of specialty jobber as formerly, since the Northwestern company has held that relation to the Westinghouse company for a long period of years.

The Alpha company has had a remarkable growth since its founding in 1912 and now ranks with the largest jobbers in the metropolitan district. It was established first at 116 West Twenty-ninth Street, but outgrew these quarters and later moved to its present location, with a warehouse at 216 West Thirtieth Street. Warehouse space has been increased 750,000 sq.ft. or about 40 per cent in anticipation of the present move.

There will be little change in the Alpha company personnel due to the new development, though some members of the Northwestern company's sales force have been retained. The officers of the Alpha company are: M. Coleman, president; G. E. Coleman, vice-president and treasurer; A. F. Thatcher, secretary, and Walter Williamson, general manager.

General Electric Establishes Radio Station

The establishment of a radio broadcasting station at its plant in Schenectady, N. Y., has been announced by the General Electric Company. This station is said by the company to be the most powerful broadcasting station in the country and has been assigned the call numbers WGY. Beginning its service unheralded a few weeks ago, the station has been picked up by amateurs in Santa Clara, Cuba, 1,450 miles south, and as far west as Cedar Rapids, Iowa, despite the fact that no attempt has been made to obtain a long-distance range. It is equipped with the multiple-tuned antennas used on the large transoceanic stations.

Art Lamp Company Takes New Manufacturing Space

The Art Lamp Manufacturing Company, 6 North Franklin Street, Chicago, manufacturer of portable lamps and shades, has leased additional manufacturing space. The entire six-story building at 218-220 Madison Street has been taken over by the company and will be fitted out for the production of the lighting specialties composing the company's line. The lease runs for twenty years. H. A. Vernon has recently been appointed sales manager.

Broderick & Bascom St. Louis Plant Destroyed by Fire

The rope-making departments of the St. Louis plant of the Broderick & Bascom Rope Company were virtually destroyed by fire last week, and the loss is estimated to be about $300,000. This causes a complete cessation of its St. Louis manufacturing activities until the plant can be rebuilt. In the meantime all work will be handled from its Seattle plant. A large foreign order and several large domestic orders were ready for shipment and were destroyed in this fire.

This is the second fire at this plant in the last six weeks. The loss in the first one amounted to about $75,000, and the output of the plant was reduced by only about 20 per cent. The company makes a specialty of stranded-steel wire rope.

Erie Equipment to Keep Plant at Johnstown

After long consideration the directors of the Erie Electrical Equipment Company, Johnstown, Pa., have decided to refuse the offer of outside interests to buy the company and will continue operations at the Johnstown plant. The company manufactures switchboard equipment and material for power-house, railway and signal construction.

The offer to buy the plant came on Jan. 15 of this year from a large company in another section of Pennsylvania, and if the offer had been accepted these interests would have purchased all the stock of the Erie company and removed the equipment to the home plant of the purchasing corporation. A campaign to dispose in the open market of a block of the Erie company's preferred stock was discontinued on receipt of the offer, but it is understood that it is to be renewed now.

On rejection of the purchase proposition the stockholders reorganized the company for the year and elected the following directors: J. L. Hershberger, J. F. Kress, J. J. Mulvehill, M. D. Beaver and H. A. Selah. J. L. Hershberger was elected president, M. D. Beaver, vice-president, J. F. Kress, treasurer, H. A. Selah, sales manager and consulting engineer, and Charles G. Kress, secretary. Mr. Selah has since resigned his position as sales manager

but remains a member of the board of directors. He has been succeeded as sales manager by S. R. Burd, and an announcement is to be made later concerning the position of consulting engineer.

The officers of the company express themselves as optimistic about the prospects of the company and are considering plans for its future development.

Eureka New England Meetings Optimistic

In preparation for a national campaign to extend from April 10 to May 13, the Eureka Vacuum Cleaner Company, Detroit, opened a series of sales meetings in New England March 20. More than 125 dealers and salesmen met at the Parker House, Boston, with Arthur M. Beveridge, New England manager of the company, presiding. The principal address was given by A. L. McCarthy, vice-president and general manager of the Eureka organization. Discussing business conditions, Mr. McCarthy said that the company's sales were only 9 per cent less in 1921 than in 1920, compared with a shrinkage of 40 per cent in the vacuum-cleaner field as a whole.

He maintained that 1922 offers opportunity for record-breaking sales through hard and persistent work. The speaker said that factory costs are less influential than sales costs at the present time in maintaining prices, owing to the expense of today's sales efforts in comparison with the "easy" business of 1920. The entire organization was urged to merchandise its product on a service basis, and it was announced that the bogie in the coming sales drive will be 35,000 outfits in thirty-five days. Other meetings were scheduled at Providence, R. I., and Hartford, Conn., 135 representatives being listed to attend.

War Contract Claim of General Electric Settled

The General Electric Company has just been a party to an unusual settlement of a claim against the federal government for closing out of war-time contracts. The company originally presented a claim of $7,560,645 against the Emergency Fleet Corporation due to cancellations of orders for turbine engines for the ship-building program. The Shipping Board contended that progress payments had more than offset the amount of the General Electric Company's claims. When the attorneys representing the two sides checked over the accounts it was found that the company, instead of being entitled to more money from the government, actually owed the board. The company then agreed to wipe out its claim of over $7,000,000 and to pay the Shipping Board $2,013,569. A check for $1,494,411 of this amount has already been tendered the Shipping Board by the company.

Westinghouse Makes Personnel Changes

Several changes in personnel have been announced recently by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., among them being transfers of various managers of district offices. R. L. Rathbone, formerly manager of the Cleveland office, has taken up special duties in connection with merchandising matters, but will continue to make his headquarters in Cleveland. J. Andrews, Jr., manager of the industrial division, Pittsburgh office, has been appointed manager of the Cleveland office, and C. D. Taylor succeeds Mr. Andrews in the Pittsburgh office. R. Seybold has been appointed manager of price statistics and among other duties will act as secretary of the domestic sales committee and will assist W. S. Rugg, assistant to the vice-president, in general duties connected with the vice-president's office. W. R. Keagy has been appointed office manager of the Cincinnati office, and J. R. Deering office manager of the Los Angeles office. H. S. Walker succeeds M. E. Lanning as promotion man in the Denver office, and I. G. Cline takes up the promotion work vacated by R. A. O'Reilly in the Chicago office. K. L. Graham succeeds to the post vacated by H. C. Hopkins as promotion man in San Francisco.

Program for National Foreign Trade Convention

Presentation of practical export subjects by experts will be one of the features of the National Foreign Trade Convention to be held in Philadelphia on May 10, 11 and 12. The program includes one session to be devoted to taxation and currency questions. "The Effect of High Taxation on Exchange," "Factor of Depreciated Currency in Competition" and "Why We Must Have Foreign Trade" are the subjects.

Shipping matters will be taken up at another general session under the heads of "The Merchant Marine," "Inland Waterways as Developers of Traffic," "Shipbuilding Prospects" and "Factors in Marine Insurance Rate Fixing." President James A. Farrell of the United States Steel Corporation will make a talk on "A Foreign Trade Policy" for Americans at another session. Topics covering all the angles of foreign trade from the viewpoint of the manufacturer, the shipper, the banker, the exporter and the importer will be taken up at the group sessions.

A method of providing means to finance foreign trade that will be stressed is the employment of the gold surplus accumulated in this country. A resolution also will be proposed asking the government to incorporate in all foreign loan agreements the condition that part of the proceeds be spent for American goods.

The United States Department of Commerce will be well represented at the convention as will be various state governments and city chambers of commerce. About one hundred trade advisers will be available to business men attending the convention.

Western Electric Reorganizes Administrative Departments

A reorganization of the administrative departments of the Western Electric Company has been announced and by this the operating functions of the company are divided into four major departments. Dr. F. B. Jewett, vice-president, is now in charge of the telephone department, which includes the engineering department, the telephone sales department and the manufacturing department. The other divisions are the general staff department, in charge of Vice-president H. A. Halligan and including the purchasing, traffic, legal, accounting, treasury and publicity personnel; the supply department, in charge of F. A. Ketcham, general sales manager, and the foreign department, under G. E. Pingree, vice-president and general manager International Western Electric Company.

W. A. Huse & Son, Providence, R. I., have been appointed Rhode Island distributers for the Monarch Refillable Fuse Company, Jamestown, N. Y.; the Howell Motor Company, Howell, Mich., and the Chicago Flexible Shaft Company's line of domestic heating appliances. The firm's headquarters are at 128 Empire Street, Providence. N. I. Allen is sales manager.

The Moe-Bridges Company has completed the construction of an enlarged branch of its factory at 933 Mission Street, San Francisco.

The Electric Specialty Company, manufacturers' agents, 525 Market Street, San Francisco, will remove its headquarters to 75 Fremont Street.

The Philadelphia Electrical & Manufacturing Company, Philadelphia, and the Electric Power Equipment Company, Philadelphia, have appointed as San Francisco district representative C. E. Ingalls, formerly San Francisco manager for the Crocker-Wheeler Company. He will have offices in the Rialto Building.

The Ajax Battery Company, Rochester, N. Y., is planning to build a new factory in that city at Norton and Hallenbeck Streets, the capacity of the present plant having been booked over a year ahead.

The Morgan-Gardner Electric Company, Chicago, has opened a Cleveland office at 1605 Williamson Building. N. Bonnist is in charge.

The Fulton Iron Works Company, St. Louis, has closed a contract with the city of Amory, Miss., for the installation of two of its Fulton Diesel engines in the new municipal central station.

The Peerless Light Company is planning a considerable enlargement of its factory branch at 149 Second Street, San Francisco.

Foreign Trade Notes

LAMPS AN IMPORTANT INDUSTRY IN HOLLAND.—The manufacture of electric incandescent lamps, the *Electrician* states, is now one of the important industries of Holland. During the first seven months of 1921 the value of the lamps exported was about £1,000,000. The exports were mainly to France, Great Britain, Spain, Argentina, Belgium, Italy and Sweden.

DECREASE IN DEMAND FOR CABLES, MOTORS AND METERS IN GERMANY.—There has been a drop in the internal demand, according to recent reports to the *Electrician*, for electric cables and wires, motors, meters and installation material in Germany, but the activity in large steam and hydro-electric plants and for telegraph and telephone apparatus continues unabated. There has also been a drop in the demand for incandescent lamps for export.

INCREASE IN PRICE OF COOKING AND HEATING APPARATUS IN GERMANY.—Owing to the general increase in prices of raw materials and advances in wages and salaries, according to the *Electrician*, the Union of Manufacturers of Electric and Cooking Apparatus of Charlottenburg, Berlin, has authorized substantial increases in the prices of electric cookers, flat iron, etc.

GERMAN INDUSTRY NOT ABLE TO COMPETE WITH OTHER COUNTRIES ON EQUAL TERMS—The industrial production efficiency of Germany is sinking more and more, the New York *Times* reports Dr. Karl Friedrich von Siemens, head of the Siemens & Halske Company, as stating in an address to the stockholders at the annual meeting. He declared that he was convinced that German industry would no longer be able to compete in the world market under equal conditions such as formerly existed between competing countries. This insufficient productivity is momentarily concealed by the difference between the purchasing power of the mark at home and abroad. He also stated that in the last business year relatively quiet working conditions had prevailed. All hopes pinned to this quieter development were destroyed with one blow, he said, by the fall of the mark, and in economic calculations chaos set in much greater than ever before. The Siemens-Halske Corporation declared a 20 per cent dividend on its 130,000,000 marks capital stock. Mr. Siemens pointed out to the stockholders that this 20 per cent paper-mark dividend was equivalent to only 0.4 per cent in gold on the par value of the stock, or 1.8 per cent in paper marks on the stock at the present market price.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Spain (No. 1,155) desires to secure an agency for the sale of electrical materials, supplies and appliances, etc.

An electrical supply firm in Brazil (No. 1,157) desires to secure agencies for the sale on commission of electrical machinery and supplies.

There is a market in Spain (No. 1,158) for electric piano players, etc.

A manufacturer in Brazil (No. 1,165) desires to receive quotations from American firms for the electrification of a cigarette factory. The material desired consists of small motors and control apparatus.

A firm of general merchants in the Netherlands (No. 1,217) desires to purchase electric vacuum sweepers.

TELEGRAPH APPARATUS FOR BRISBANE, AUSTRALIA. — Tenders will be received at the Postmaster-General's Department, Brisbane, Australia, until April 19, according to the *Empire Mail*, for furnishing testing and telegraph instruments, including direct-current ammeters, alternating-current bridge condenser coils, condensers, cross-talk meters, detectors, milliammeters, artificial telephone cable boxes, etc. Tenders to be addressed to the Deputy Postmaster-General, Brisbane, Australia.

ELECTRIC CABLES FOR SWISS FEDERAL RAILWAYS. — Tenders are being asked, according to the *Electrician*, for furnishing electric cables in connection with the project for the electrification of the Swiss Federal Railways. Foreign tenders will be considered on this occasion. The scheme will involve the ultimate electrification of 3,000 miles. The adoption of electric traction on branch lines is also under consideration.

New Apparatus and Publications

BOXES.—A line of pressed-steel switch boxes has recently been placed on the market by the Ward Electric Company, Otis Building, Philadelphia.

TESTING DEVICE.—A device for testing electrical parts and locating faults in all makes of electrical systems of automobiles ("Tes-tor") has been developed by the Plucker Electric Products Company, New Britain, Conn.

BELL.—The Schwarze Electric Company, Adrian, Mich., has placed on the market an electric bell ("Cyclone") designed for fire-alarm use in schools and industrial plants.

RECTIFIER.—The France Manufacturing Company, Berea Road and West 104th Street, Cleveland, has recently placed on the market a continuous-charge ("F-F") rectifier for floating battery systems.

MAGNETIC WAVE GENERATOR.—The Bachelet Medical Appliance Company, Inc., Kingston, N. Y., manufacturer of electrical therapeutic apparatus, has brought out an electromagnetic therapeutic wave generator.

RADIO APPARATUS.—A complete wireless-telephone receiving set has recently been developed by the Radio Receptor Company, 126 Liberty Street, New York City.

SWITCH.—The Union Electric Manufacturing Company, Milwaukee, has recently placed on the market the "Unelco" safety motor-starting switch.

CONNECTOR. — The Magnus Electric Company, 115 Broad Street, New York City, has recently developed an extension-cord connector.

FIXTURE. — The Will-Burt Company, Orrville, Ohio, has recently placed on the market a new lighting fixture ("Flexolite") for lighting mills, factories and shops.

HOT PLATE.—The Liberty Gauge & Instrument Company, 6545 Carnegie Avenue, Cleveland, has put out an electric hot plate.

WASHING MACHINE. — The Cadillac Washing Machine Company, 325 West Ohio Street, Chicago, has brought out a new washing machine with a folding, swinging wringer.

KITCHEN APPLIANCE.—An electrical appliance, known as the "Kitchen Girl," which may be used for many kitchen duties, has been placed on the market by the Kitchen Appliance Corporation, Marsh Building, Pontiac, Mich.

PLATE PRESS.—The Battery Equipment & Supply Company, 1458 South Michigan Avenue, Chicago, has placed on the market the "Besco" plate press.

CRANES. — The Whiting Corporation, Harvey, Ill., is distributing a four-page circular and a desk calendar calling attention to its complete line of equipment, including electric and hand power travelers, bucket-handling and gantry, jib, pillar and bracket cranes, foundry equipment, trolley systems, etc.

COUPLINGS. — The Thomas Flexible Coupling Company, Warren, Pa., is distributing a catalog covering the Thomas flexible couplings for all direct-connected machines.

COMMUTATOR STONES.—The Martindale Electric Company, 11737 Detroit Avenue, Cleveland, has issued a new four-page circular on commutator grinding and slotting, which describes its "Imperial" commutator stones and three devices for undercutting mica.

MOTORS.—The ALP Electric Manufacturing Company, 325-327 East Ferry Street, Newark, N. J., has issued a bulletin on its "ALP" alternating-current motors in sizes 1 hp., to 50 hp. Both ball and sleeve bearings are embraced.

INDUSTRIAL TRUCK. — The Elwell-Parker Electric Company, Cleveland, has perfected and placed upon the market a drop-frame electric industrial truck for low-loading of heavy materials.

CARBON ELECTRODES.—The National Carbon Company, Inc., New York, has issued a second edition of "The Carbon Electrode," a seventy-nine page booklet on the history, manufacture, handling, care and use of carbon electrodes.

PORTABLE TOOLS. — The Black & Decker Manufacturing Company, Towson Heights, Baltimore, is distributing a miniature catalog covering its various portable electric tools.

HIGH-VOLTAGE DETECTOR.—Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, have put on the market an instrument for detecting the presence of high potential on lines, transformers and other apparatus.

RADIO APPARATUS. — The "Aeriola, Sr.," a regenerative radio receiver, and the "Vocarola," a radio reproducing apparatus which serves the purpose of a sound chamber, have been put on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Companies

THE WINDHAM VALLEY ELECTRIC COMPANY, Windham, N. Y., has been incorporated with a capital stock of $25,000 to operate in Green County. The incorporators are E. E. Munson, S. A. Moseman and W. W. Vining. B. I. Tallmadge, Windham, is attorney.

THE INLET LIGHT & POWER CORPORATION has filed articles of incorporation with a capital stock of $50,000 to operate in Herkimer County. The incorporators are J. and E. Routstone and E. C. Baker. Colegreve & Baker, Utica, are attorneys.

THE RIPLEY POWER & WATER COMPANY, Riverside, Cal., has been chartered with a capital stock of $70,000 by J. N. Hesley, J. O. Phillips, A. Villman, Frank Sabathe and Harris Hollenbeck.

THE KEYSTONE POWER CORPORATION OF DELAWARE has filed articles of incorporation with a capital stock of $11,000,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are T. L. Croteau, M. A. Bruce and C. H. Blaske, Wilmington, Del.

THE EXCEL ELECTRIC COMPANY has been organized at Muncie, Ind., by James H. Reichart, Samuel W. Huffer and Samuel A. Martin. The new company is capitalized at $20,000 and will engage in the electrical supply business.

Record of Electrical Patents

Notes on United States Patents

(Issued March 7, 1922)

1,409,061. ELECTROMECHANICAL POWER TRANSFORMING, CONVERTING AND REGENERATIVE DEVICE; Howard J. Murray, Brooklyn, N. Y. App. filed Nov. 21, 1918. Alternating-current railway motor.

1,409,124. METHOD OF PRODUCING NITROGEN COMPOUNDS; Heinrich Specketer, Griesheim-on-the-Main, Germany. App. filed Jan. 6, 1922. By heating metallic oxygen compounds with coal and nitrogen.

1,409,131. ELECTRIC IRON; Frank B. Widmayer, New York, N. Y. App. filed Nov. 20, 1920. Detachable section converts light iron to heavy one.

1,409,135. SIGNAL; John A. des Rosiers and Martin W. Webb, Edmonton, Alberta, Canada. App. filed May 11, 1920. Danger light for automobiles.

(Issued March 14, 1922)

15,310 (reissue). MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed March 11, 1919. Prevents hunting in trunk selection.

1,409,147. BATTERY HANDLAMP; Ernest Alschuler, Chicago, Ill. App. filed April 30, 1919. Constructed to prevent accidental lighting.

1,409,173. TROLLEY CONSTRUCTION; James F. Healy, Chicago, Ill. App. filed June 18, 1921. Pole forms plunger in vertical tube and is held in contact by fluid pressure.

1,409,216. RACE TOTALIZATOR; George A. Julius, Sydney, New South Wales, Australia. App. filed April 30, 1919. Electric totalizing machine for recording ticket sales of several booths.

1,409,253. SPARK-PLUG INTENSIFIER AND TESTER; James H. Smith, Elza, Ga. App. filed Oct. 31, 1919.

1,409,341. SUBMARINE SIGNALING; Henry C. Harrison, Fort Washington, N. Y. App. filed July 12, 1919. For detecting other vessels while submerged.

1,409,362. TELEGRAPH SYSTEM; George E. Cummings, East Orange, N. J. App. filed May 28, 1918. Balancing on duplex equipment.

1,409,365. MAXIMUM-DEMAND METER; Leo Dorfman, Pittsburg, Tex. App. filed April 21, 1919. Logarithmic type.

1,409,376. ATTACHMENT FOR TROLLEY POLES; James F. Healy, Chicago, Ill. App. filed June 20, 1921. To prevent accidental disengagement.

1,409,383. CHEMICAL RECTIFIER; Thomas M. Lane, Alameda, Cal. App. filed Feb. 9, 1920. To rectify alternating current.

1,409,386. TELEGRAPH SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed July 1, 1918. Arrangement for blind or deaf person receiving by sense of touch.

1,409,439. X-RAY MACHINE; Charles Fayer, New York, N. Y. App. filed Aug. 2, 1917. Breaking of secondary circuit to be positive and uniform.

1,409,460. PRESSURE REGULATOR FOR VACUUM TUBES; Arthur Mutscheller, New York, N. Y. App. filed Nov. 4, 1918. Adapted for use in X-ray tubes.

1,409,502. TIME-INDICATING APPARATUS; Henry E. Warren, Ashland, Mass. App. filed June 18, 1920. Means for accurately setting a timepiece.

1,409,561. AUTOMATIC MULTIPLE-SWITCH CONTROLLING MACHINE; Everett A. Margeson and Charles D. Herrold, San Jose, Cal. App. filed Aug. 4, 1920. Automatic street indicator for trolley car.

1,409,586. APPARATUS FOR CONTROLLING MOVEMENTS AT A DISTANCE; Joseph L. Routin, Paris, France. App. filed June 24, 1919. Indicates and repeats angular movements.

1,409,637. METER-TEST APPARATUS; Fredrick Zenker, Highland Park, Mich. App. filed July 26, 1917. Safety-cabinet switch device.

1,409,647. HEATING TRANSFORMER; Paul H. Bardill, Dubuque, Iowa. App. filed March 1, 1921. Portable electrically heated hot-water radiator.

1,409,669. ELECTRIC FURNACES; Cranston H. Carpenter, Irwin, Pa. App. filed Aug. 6, 1920. Current flows through material receptacles.

1,409,670. CONTROL APPARATUS; Lewis W. Chubb, Pittsburgh, Pa. App. filed June 9, 1919. Variable liquid rheostat.

1,409,681. STARTING MECHANISM FOR ENGINES; Edward A. Dickey, Wireton, Pa. App. filed June 28, 1920. Electric motor for combustion engines.

1,409,717. SYSTEM OF TRANSFORMING ENERGY; Peter Hewitt, Ringwood Manor, N. J. App. filed Oct. 29, 1915. By mercury-arc tube.

1,409,727. METHOD OF PRODUCING PURE ZINC SOLUTION; Emanuel Kardos, Newark, N. J. App. filed Dec. 20, 1919. By electrolysis.

1,409,736. POWER PLANT; John M. Lea, Detroit, Mich. App. filed Aug. 8, 1919. Separate gas engine for automobiles to run storage-battery generator.

1,409,737. AUTOMATIC TELEPHONE SYSTEM; Thomas Lenaghan, Croydon, England. App. filed Nov. 2, 1920. Refers to contact switches.

1,409,782. ELECTROLYTIC APPARATUS FOR PREPARING HYPOCHLORITE SOLUTIONS; David McG. Rogers and Arthur T. Masterman, London, England. App. filed Nov. 30, 1921. For bleaching and disinfecting.

1,409,788. MEASURING THE SO-CALLED FIRING DELAY FOR NAVAL GUNS; Ludwig Schon, Essen, German. App. filed Nov. 19, 1920.

1,409,839. SPEED INDICATOR; William A. Erner, Dubuque, Iowa. App. filed Nov. 1, 1920. That traffic officers may know speed without pacing a machine.

1,409,874. STREET REGISTER OR INDICATOR; Edward T. McCabe, Cleveland, Ohio. App. filed June 10, 1919. Trolley-car automatic street indicator.

1,409,879. REGISTER; Henry E. Manley, Olean, N. Y. App. filed April 25, 1919. Used with orifice meters.

1,409,889. SYSTEM OF ELECTRICAL REGULATION; William A. Turbayne, Niagara Falls, N. Y. App. filed Jan. 24, 1920. For operating automobile storage-battery generators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BURLINGTON, VT.—The Electric Light Department contemplates the installation of an ornamental lighting system on Church Street. M. G. Clark is superintendent.

NORTH TROY, VT.—The Blair Veneer Company has applied to the Public Service Commission for permission to amend its charter so as to enable it to generate and distribute electricity for lamps and motors in North Troy and vicinity.

BOSTON, MASS.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until April 12 for the installation of coal-handling equipment at the post office power plant. (Specification 4583.)

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., about April 15 for construction and equipment of a substation, distributing system and first-aid station at the South Boston Navy Yard (Specification No. 4550). The equipment will include a three-unit motor-generator set, 250-kw., 2,300-volt alternating-current to 140-volt direct-current, a 2,300-volt alternating-current to 250-volt direct-current, an exciter set and a nine-panel switchboard, with accessories. The cost of the entire work is estimated at about $100,000.

LOWELL, MASS.—Application has been made to the Department of Public Utilities by the Lowell Electric Light Corporation for permission to issue $297,200 in capital stock, the proceeds to be used for extensions and improvements.

MARION, MASS.—At the town meeting held recently the citizens voted to install fifty additional street lamps in East Marion.

MERRIMAC, MASS.—At a recent town meeting the proposal to extend the commercial electric lighting service on the Lake Attitash Road was carried.

MITTENEAGUE, MASS. — Motors and other electric equipment will be installed in the four-story mill addition, 25 ft. x 200 ft., to be erected by the Strathmore Paper Company.

SHIRLEY, MASS.—The Tyngsboro Electric Light Company, which serves the towns of Shirley, Dunstable and Tyngsboro, and the Pepperell (Mass.) Electric Light Company have been consolidated under the name of the Middlesex County Electric Company. The new company contemplates improvements to the service.

PROVIDENCE, R. I.—The Narragansett Electric Light Company is taking bids for the erection of its proposed plant on Melrose Street, consisting of a one- and two-story power plant, 40 ft. x 56 ft.; two service buildings, one of which will be equipped with two electric traveling cranes, and other miscellaneous structures. Jenks & Ballou, 1035 Grosvenor Building, are engineers.

HARTFORD, CONN.—The Fuller Brush Company, 547 Asylum Street, will build a power house at its proposed plant on Windsor Avenue. Buck & Sheldon, Inc., 60 Prospect Street, are engineers.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack & Southern Power Company is being organized by interests connected with the United Hudson Electric Corporation, Poughkeepsie, and the Adirondack Power & Light Corporation, Amsterdam, to build a transmission line connecting the systems of the two companies at Coeymans and Bethlehem town lines.

BROOKLYN, N. Y.—The Brooklyn Edison Company, 360 Pearl Street, contemplates the erection of a two-story power house, 79 ft. x 127 ft., on Wakeman Place, to cost $300,000.

BROOKLYN, N. Y.—The new plant of the Brooklyn Yarn Dye Company, Neptune Avenue and Twenty-third Street, will include a one-story power house, 50 ft. x 50 ft. Arthur J. Adams is treasurer.

BUFFALO, N. Y.—The National Biscuit Company, New York, will erect a power plant at its factory on Belt Line Street, Buffalo, to cost about $1,000,000, with machinery.

CASTILE, N. Y.—The Board of Trustees has contracted with the Long Island Lighting & Power Company for commercial electric service.

CHAZY, N. Y.—W. H. Miner will build an electric power plant in Chazy for commercial service, to cost about $45,000.

DUNKIRK, N. Y.—Bonds to the amount of $65,000 have been voted for the installation of a fire-alarm and police-call telegraph system.

NEW YORK, N. Y.—Bids will be received by James A. Hamilton, commissioner of correction, Room 2402, Municipal Building, until April 4 for furnishing and installing one two-unit motor-generator set with switchboard, transformer and all necessary wiring in dynamo room at the Reformatory Prison, Hart's Island, Bronx.

NEW YORK, N. Y.—Bids will be received by the Board of Purchase of the City of New York, Room 526, Municipal Building, until April 4 for furnishing electric lamps to Bellevue and Allied Hospitals. Bids will also be received until April 3 for furnishing lamppost castings to the Department of Water Supply, Gas and Electricity.

NEW YORK, N. Y.—The Long Island Lighting Company, 50 Church Street, has acquired the plants and properties of the Southold Lighting Company, the Riverhead Light Company and the Consumers' Gas Company and will merge the plants with its system. A number of improvements will be made.

SCARSDALE, N. Y.—The contract for the electrical and mechanical equipment for the new pumping station has been awarded to John R. Proctor, Inc., 120 Liberty Street, New York City. The George A. Johnson Company is engineer.

SYRACUSE, N. Y.—A power plant will be established in connection with the hotel to be erected at East Onondaga and South Warren Streets by the Syracuse Hotel Corporation, Gurney Building, to cost $3,000,000. George B. Post & Sons, 101 Park Avenue, New York, are architects.

WATERTOWN, N. Y.—Work will soon begin on the construction of a hydro-electric plant at Browns Falls, near Watertown by the Northern New York Utilities, Inc. The cost is estimated at $100,000.

CAMDEN, N. J.—The seven-story furniture factory to be erected by the J. B. Van Sciver Company, adjoining its present plant, to cost about $500,000, will be equipped throughout with electrically driven machinery. The Ballinger Company, 105 South Twelfth Street, Philadelphia, is architect.

FRENCHTOWN, N. J.—Plans are being prepared for an extension to the municipal electric light and power plant. The Causbey Engineering Company, 1011 Chestnut Street, Philadelphia, is engineer.

JERSEY CITY, N. J.—The Lehigh Valley Railroad Company, 143 Liberty Street, New York, will build a substation in connection with a mechanical shop at the foot of Chapel Avenue, to cost $150,000.

NEWARK, N. J. — George C. Bergen, county purchasing agent, Court House, will receive bids until April 25 for furnishing incandescent lamps for county institutions for a period of one year.

SERGENTSVILLE, N. J.—The Eureka Power Company, Trenton, contemplates extending its transmission line from Stockton to Sergentsville. The company has contracted to supply power for the new plant of the American Clay Products Company, New Hope, Pa.

ALLENTOWN, PA.—The Council contemplates the installation of an ornamental street-lighting system on North Sixth Street from Linden to Chew Street.

CARLISLE, PA. — The Electric Light Committee will soon call for bids for an ornamental lighting system on Hanover and High Streets. O. H. Starner is chairman.

KANE, PA.—The Keystone Power Corporation has preliminary plans under way for a 15,000-kw. electric plant. The company has issued $1,750,000 in bonds, part of the proceeds to be used for plant and transmission-line construction. N. M. Argabrite is vice-president.

PHILADELPHIA, PA. — The Collins & Aikman Company, 4,675 Nixon Street, will build a one-story power house at Viola and Leidy Streets.

SHAMOKIN, PA.—The Roaring Creek Water Company is planning to install an electrically operated pumping plant at its waterworks. William H. Dechant, 632 Washington Street, Reading, Pa., is engineer.

SUNBURY, PA. — The Sunbury Water Company is having plans drawn for a one-story power house, 50 ft. x 50 ft. William H. Dechant, 632 Washington Street, Reading, Pa., is engineer.

UPPER DARBY, PA.—The Philadelphia & Garrettford Street Railway has applied to the Public Service Commission for permission to issue $165,000 in bonds for improvements to its electric system.

WILBURTON, PA. — The Pennsylvania Power & Light Company, Allentown, will extend its transmission line to Wilburton and vicinity.

WILMINGTON, DEL.—The Street and Sewer Department is considering improvements to the street-lighting system.

HAGERSTOWN, MD. — The Western Maryland Railway Company has contracted with the Hagerstown & Frederick Railway Company to supply electricity for its local yards. The present power plant will be dismantled. New motors from 600 hp to 350 hp., an air compressor, etc., will be installed.

CHESAPEAKE, W. VA.—A. C. Singer and associates contemplate the construction of an electric power plant in Chesapeake, to cost about $40,000. A franchise has been granted.

FAIRMONT, W. VA.—The Virginia & Pittsburgh Coal Company will electrify all departments at its Kingmont mining plant. Electricity will be secured from the Monongahela Power & Railway Company.

MADISON, W. VA.—The Kentucky & West Virginia Power Company, Logan, has applied for a franchise to supply electricity in Madison.

RIVESVILLE, W. VA. — Motor-driven centrifugal pumps and other electric machinery will be installed at the municipal waterworks, at a cost of about $50,000. B. Kress, Elkins, is engineer.

WEST SPRINGDALE, W. VA. — The American Gas & Electric Company, 30 Church Street, New York, will soon commence work on an addition to its local plant, to cost about $1,000,000, including transmission-line extensions. Sanderson & Porter, 52 William Street, New York, are engineers.

WHEELING, W. VA. — The Wheeling Machine Products Company contemplates the installation of a new power plant.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, War Department, until April 7 for a large quantity of switchboard and lineman's tools (Circular PR, 10340-9CP); also until April 8 for 562 condensers for signal service (Circular 10370-1CP).

WASHINGTON, D. C.—Bids will be received at the office of the District Commissioners, District Building, until April 10 for one motor-driven multistage centrifugal pump for the District Workhouse.

North Central States

DETROIT, MICH.—The Council is considering a recommendation of Mayor Couzens for an appropriation of $4,000,000 in the annual budget for the construction of an electric generating plant for the municipal transit system.

EVART, MICH.—The Council is considering rebuilding the municipal power plant.

MARQUETTE, MICH.—The Council has authorized bids to be asked for the installation of an additional generating unit at the municipal hydro-electric plant on Dead River.

OWOSSO, MICH.—The Council contemplates the installation of an ornamental street-lighting system in the business district.

ROCKFORD, MICH.—The Kirth-Krause Company contemplates building a power plant, to cost about $55,000. B. Parks & Son, Michigan Trust Building, Grand Rapids, Mich., are engineers.

AKRON, OHIO. — The Northern Ohio Traction & Light Company has issued $7,500,000 in bonds, part of the proceeds to be used for extensions to its system.

BELLEFONTAINE, OHIO. — Improvements are contemplated to the municipal electric light plant, including the installation of a 600-kw. turbo-generator unit, an additional boiler and condenser equipment, etc. The cost is estimated at $91,000. The proposal to issue bonds for the above will be submitted to the voters at a special election to be held April 4.

CLEVELAND, OHIO.—The Western Reserve University, Euclid Avenue, will build a power plant in connection with a five-story medical building at Cummington and Abbington Roads, to cost in excess of $2,000,000. Coolidge & Shattuck, Ames Building, Boston, are architects. Sidney S. Wilson, Ninth Street and St. Clair Avenue, Cleveland, is secretary and treasurer.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 219, City Hall, until April 7 for furnishing and delivering to the various departments of the city, Board of Education and public library all the lamps required for a period of one year, to cost approximately $50,000.

HAZARD, KY.—The Kentucky & West Virginia Power Company, Logan, W. Va., has completed plans for the construction of a three-story addition to its local power plant. F. R. Weller, Mills Building, Washington, D. C., is consulting engineer.

CAMPBELLSBURG, IND. — The Interstate Public Service Company contemplates extending its transmission line from Salem to Campbellsburg, a distance of about 12 miles.

AURORA, ILL.—The Western United Gas & Electric Company contemplates extensions and improvements to its system in the Fox River district, to cost about $1,000,000.

CHICAGO, ILL. — The Chicago, Rock Island & Pacific Railroad, LaSalle Street Station, contemplates the installation of radiophone and radiograph apparatus on its passenger trains.

ROCKFORD, ILL.—The Rockford Electric Company plans extensions to its power plant and distributing lines, to cost about $350,000.

ASHLAND, WIS. — Contract has been awarded by the Ashland Light & Power Company to the L. E. Meyers Company, 53 West Jackson Boulevard, Chicago, consulting and contracting engineers, for the construction and equipment of a hydro-electric plant on the Flambeau River, near Tony, to cost about $3,500,000. The equipment will include three 5,000-hp. turbo-generating units. About 150 miles of transmission lines will be erected.

MADISON, WIS.—The Madison Gas & Electric Company, it is reported, will soon ask for bids for an addition to its steam generating plant to increase the output by 5,000 kw. New equipment, including a 1,000-hp. Stirling boiler, automatic stoking equipment, coal-handling machinery, etc., will be installed. Mead & Seastone, Madison, are consulting engineers.

MARSHALLTOWN, IOWA.—Plans are being prepared for a one-story power house at the Deaconess Hospital, for which bids will soon be asked. H. E. Reimer is architect.

KANSAS CITY, MO.—Contracts for cable, conduit, instruments, etc., it is understood, will soon be awarded by the Fire and Water Board for a new underground fire-alarm system.

MARSHALL, MO.—The Board of Works has plans under way for an addition to the municipal power plant, to cost about $25,000. An engine-driven generator and other equipment will be installed.

ST. LOUIS, MO. — The Union Electric Light & Power Company has secured a site on the Illinois side of the Mississippi River, near the city limits of East St. Louis, Ill., on which it proposes to erect a power plant, to cost, including equipment, more than $6,000,000. McClellan & Junkersfeld, 45 William Street, New York, are engineers.

WINFIELD, MO. — The Winfield Levee and Drainage District will install an electric pumping plant in connection with an irrigation development. W. H. Jackson, Sr., is secretary.

VELVA, N. D.—The Velva Coal Products Company, Valley City, is planning the construction of a power plant at Velva, to cost about $750,000. The Dakota Engineering Construction Company, Valley City, is engineer. W. J. Bliss is head.

HOLTON, KAN.—The Council will receive bids until April 10 for a 100-kw. generator and other equipment for the municipal power plant. Black & Veatch, Mutual Building, Kansas City, Mo., are consulting engineers.

KANSAS CITY, KAN.—The Council will install an ornamental street-lighting system on Kansas Avenue and Packard Street.

SEDAN, KAN.—The Council will install an ornamental street-lighting system, to consist of fifty-four lamp standards, in the business district.

WALDRON, KAN. — The Council has awarded a contract to the Tri-State Electric Company, 1,002 Southwest Boulevard, Kansas City, Mo., for the construction of a transmission line to Anthony. A local distributing system will be installed. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

Southern States

SAVANNAH, GA.—The Savannah Electric Company contemplates additions and improvements to its system during the present year, to cost about $360,000. R. C. Brooks is manager.

PALATKA, FLA.—The Council is considering the erection of a municipal electric plant, to cost about $25,000.

SAFETY HARBOR, FLA.—The Council has authorized plans for an addition to the municipal electric lighting plant.

GERMANTOWN, TENN.—The construction of a municipal lighting plant, to cost about $25,000 is under consideration.

VICKSBURG, MISS. — New equipment will be installed in the power house at the municipal waterworks. J. J. Hayes, Mayor, is in charge.

DONALDSON, ARK. — The Arkansas Light & Power Company will install a local distributing system. Service will be furnished from the transmission line now being built from Little Rock to Malvern, Ark. C. P. Couch is manager.

FAYETTEVILLE, ARK. — The Council will install an ornamental lighting system from the business district to the University section.

HAMMOND, LA.—Plans are being prepared for the installation of a new street-lighting system, to cost about $25,000.

LAFAYETTE, LA. — A committee has been appointed to investigate the proposition of leasing the municipal electric plant to private interests.

MUSKOGEE, OKLA.—The Council has authorized estimates of cost made for a municipal light and power plant.

PONCA CITY, OKLA.—The City Commissioners are having estimates of cost made for the construction of a transmission line to Redrock, Bliss and vicinity. With the building of this line the Redrock Council will abandon its tentative plans for the installation of a municipal lighting plant.

WOODWARD, OKLA.—The Council has awarded a contract to Carrothers & Pitburn, Commerce Building, Kansas City, Mo., for a power house for the municipal electric plant. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are consulting engineers and will receive all equipment bids.

FORT BLISS, TEX.—The Quartermaster Supply Office will receive bids until April 6 for 5,900 electric meters (Circular 61).

FORT WORTH, TEX.—The Southwestern Power & Light Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

Pacific and Mountain States

MILTON, ORE.—The Council has filed an application with the State Engineer for permission to use water from the Walla Walla River for a municipal hydro-electric plant. The project will include a 60-ft. dam and 2½-mile pipe line.

TACOMA, WASH.—The Council has authorized the Commissioner of Light and Water to call for bids for 500 ornamental lamp poles and 50,000 ft. of armored cable.

CORONA, CAL.—The installation of an ornamental lighting system on Sixth and Main Streets and Grand Boulevard is under consideration. E. F. Clarke, secretary of the Chamber of Commerce, is in charge.

SACRAMENTO, CAL.—Plans are being prepared by Albert Givan, city engineer, for the installation of an ornamental street-lighting system in lighting district No. 10.

SAN FRANCISCO, CAL.—The Board of Public Works, it is reported, will receive bids until April 12 for equipment for the Moccasin Creek power plant of the Hetch-Hetchy project in Tuolomme County, to cost about $1,000,000. The equipment will include four electric generating units, having a capacity of 25,000 hp. each. This is the first of several large hydro-electric installations in connection with the Hetch-Hetchy project. M. O. Shaughnessy is city engineer.

SAN PEDRO, CAL.—Steps have been taken by the residents and property owners on Sixth, Seventh and Palos Verde Streets for the installation of an ornamental street-lighting system.

BRIGHAM CITY, UTAH. — The City Council has decided to install a new street-lighting system on North and South Main Streets.

SALT LAKE CITY, UTAH.—The City Commission has voted to advertise for jurisdiction and to call for bids for the installation of a residential lighting district on Yale Avenue for four and one-half blocks. The plans call for forty-two ornamental standards. Bids will be opened April 4.

Canada

BRANTFORD, ONT.—The establishment of an auxiliary lighting plant at the General Hospital is under consideration by the board of trustees.

TORONTO, ONT. — The Hydro-Electric Commission is arranging a program for extensions and improvements to its system, to cost approximately $3,500,000.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ASSOCIATION OF OPERATING ENGINEERS. Secretary, H. C. Bristol, Calderwood, Tenn.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa. Annual convention, Baltimore, April 27-29.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 143 Liberty St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Niagara Falls, Ontario, June 26-30.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 26 to July 1.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, Spring Lake Beach, N. J., June 19-25.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

BRITISH COLUMBIA ELECTRICAL CO-OPERATIVE ASSOCIATION. Field manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

ELECTRIC POWER CLUB. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

ELECTRICAL SAFETY CONFERENCE. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Hot Springs, Va., May 24-26.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 165 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Directory of Electrical Associations

Printed in the First Issue of Each Month

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Daytona, May 15-16.

GREAT LAKES GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN ELECTRIC LIGHT ASSOCIATION. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo. Annual meeting, Columbia, Mo., May 4-6.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

NATIONAL COUNCIL LIGHTING FIXTURE MANUFACTURERS. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., West 65th St. and Detroit Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, New York Transit Commission, New York City.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Convention, Atlantic City, May 15-20.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, W. J. Kreger, 47 West 34th St., New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION, GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual meeting, St. Paul, Minn., June 13-15.

NORTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho. Annual meeting, Boise, Idaho, June 7-10.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, Ohio, July 11-14.

OKLAHOMA UTILITIES ASSOCIATION. Acting secretary, O. D. Hall, Oklahoma City.

ONTARIO ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal. Annual meeting, Los Angeles, May 31-June 3.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, Renville H. McMann, 150 Nassau St., New York City.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla. Annual meeting, San Antonio, Tex., May 3-6.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex. Annual meeting, San Antonio, Tex., May 3-6.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Convention, Spartanburg, S. C., April 19-21, 1922.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

WEST VIRGINIA-KENTUCKY ASSOCIATION OF MINE, MECHANICAL AND ELECTRICAL ENGINEERS. Secretary-treasurer, Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington, W. Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, W. M. Chester, 1408 First National Bank Bldg., Milwaukee, Wis.

WYOMING UTILITIES ASSOCIATION. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.